ELECTRICAL REVIEW

[ILLUSTRATED]

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Convenient Telegraph Instruments.

The following illustrations show some very popular styles of small instruments.

To design a pocket relay which combines sensitiveness, loud sounding, and strength of parts, has been the aim of many manufacturers, few of whom seem to have succeeded in any great degree.

Among the prevailing faults may be mentioned:

The extreme "stubbiness" of the key lever (frequently being short enough to be placed crosswise the narrow case), which may consist of a cheap flat spring fixed at one end, with key knob and platinum point at the bottom, or a short brass bar clumsily hinged, so that in either case the key will work in a "crampy" manner.

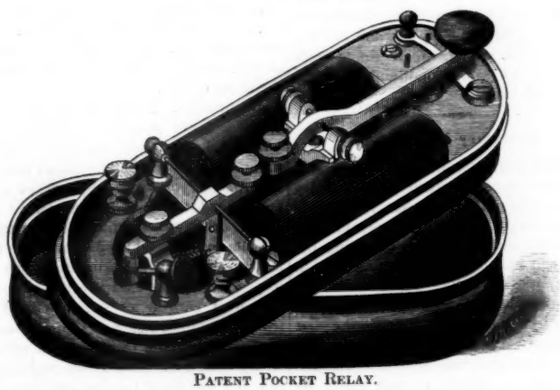
The relay armature lever is usually without a shaft, and like the brass bar key lever, is "hinged in a way to produce the maximum amount of resistance by friction.

They have evidently fallen into the error of trying to produce new forms of keys and relays requiring smaller space than the regular patterns, instead of arranging the approved forms in ordinary use with the greatest possible economy of space.

The patent pocket relay made by the Western Electric Company contains, as shown in the cut, a regular key with a curved lever three inches long, and a relay with a long shaft delicately pivoted. In both of these points they conform to what use has shown to be the best forms of construction.

We also show a patent cutout, which is not a novelty, having been favorably known as the "Gray and Barton cutout" before that firm was merged in the Western Electric Manufacturing Company. It is a form of quick switch, lightning arrester, and cutout, which has stood the test of years and is still a favorite.

PATENT CUTOUT, WITH LIGHTNING ARRESTER AND GROUND SWITCH. ALL CONNECTIONS ARE ON TOP.



PATENT POCKET RELAY.

The Scimitar of Science

STRIKES THE SCALES OF ERROR FROM THE EYES OF IGNORANCE, IN HOUSTON, TEXAS.

We clip the following article from the *Post*, of Houston, Texas. It has the merit of being graphic in diction and startling in statement, and as such we submit it to our readers:—

Not one by one, but in countless numbers, the scales of error are stricken from the eyes of ignorance by the scimitar of science. Day by day the car of progress rushes along the causeways of knowledge with constantly accelerated speed, crushing into the dust of oblivion the obstructions that choked up the paths of science, and bearing aloft the torch of discovery enlightening the world. The impossible has become the possible. The seeds of scientific research planted by Descartes, by Newton, by Herschel, by Arrago, by Morse, in the fruitful field of natural philosophy, under the irrigating influences of the beginning of the end of the nineteenth century, have grown into sturdy oaks of knowledge, upon whose trunks and branches the minds of a host of brilliant searchers after the

FAMED PHILOSOPHER'S STONE

have poured, in ever brightening succession, the radiance of their discoveries.

James I. Watts's boiling tea-kettle, with its dancing lid, has grown into the billions of lungs of steel that hurtle across the boundless oceans the navies of the world; across the lands move the products of the mines and fields garnered by countless millions, and weave and work into myriads of fabrics the yields of forest, field, mountain and river. Franklin's kite-string, now, not only binds pole to pole, zone to zone, island to continent, people to people in a steely net-work of intelligence, but it has disentangled the tongues tied at the tower of Babel nearly six thousand years ago, and furnished the torch by which to read the tidings itself has flashed around the world.

Notwithstanding the immense strides made in the application of electricity as a motor in the thousand and one various services it performs for modern civilization, whether it be to transmit the human words from eye to eye, though thousands of miles intervene between the thinkers; to avert from human lives the thunderbolts that dash from sky to earth, or to propel the wheels of commerce, or the shuttles and spindles in the whirling looms of manufactories, the varied uses of

THE ELECTRIC FLUID

seem as yet to be in their infancy, in the face of the wonderful discoveries, made almost every day in the versatility of its adaptation as a motive power in solving every problem which may arise in dynamics.

In no branch of the multiplex uses of electricity is this more true than in telegraphy. It is not the purpose nor the scope of this cursory article to give a history of this branch of science. The time and space at the disposal of the writer and, moreover, the familiarity with the subject of most of the readers of *The Post*, forbid such a talk.

Summarized, the most important improvements made in telegraphy cover a period of about thirty years, to wit: The invention of Siemens and Halske in 1854, by which two messages could be sent out in different ways from the same instrument. The modifications made by Stearns in the arrangement of Siemens and Gintl obviated all practical difficulties and made duplex and even quadruplex telegraphy a success in the United States. The phonetic system of Gray and Bell (still in its infancy) aims to increase indefinitely, the number of messages sent simultaneously over a single wire by using tuning forks moved by electro-magnets, for sending and receiving the signals. Other inventors have followed within the last year or two in the line blazed out by these discoverers, and busy minds are vieing with one another in the development of the vast undiscovered possibilities that lie before them in this boundless mine of scientific knowledge.

The most astonishing of all these discoveries, it has fallen to the share of a young man who has lived right here in Houston to make.

Mr. M. C. Connolly, who, until last year, worked as Night Chief in the office of the Western Union at this point, since he ceased to man a battery, and engaged in literary pursuits, has occupied his leisure time in working out a problem that, like Banquo's ghost, "would not down" in his busy thoughts. During the Interstate Drill Mr. Connolly was in Houston for a few days, and while here he confided the deductions and reasoning of his discovery to the electrician of *The Post* under an injunction of secrecy.

The seal has now been removed from the lips of *The Post* man by Mr. Connolly writing to a friend in this city that his dream had proved a reality; that his invention has been shown, by continued and severe experiment, to be a complete success; that he has tested it in the presence of a number of capitalists, and they have agreed to furnish him all the means necessary to introduce it to the notice of the leading electricians in this country and Europe.

In early years, "Mike" Connolly (as his old fellow tickers love to call him) conceived a fondness for the electrical science, and the practical knowledge, which years of standing by the batteries and playing on the keys gave him, enabled him to master with readiness all the subtle principles which underlie the art of telegraphy. About three years ago Mr. Connolly conceived the idea that the elecric fluid was refrangible, in the same way as the rays of light, proceeding from different sources, and traveling varying distances to a common local center, derive multiplied intensity from their concentric power.

As there exists a common tie of resemblances between the great phenomena of Motion, Heat, Sound, Light and Magnetism, Mr. Connolly very sensibly reasoned that the rule governing the refrangibility of light was, under a modified condition of treatment, applicable to electricity. He first began his experiments with discs of various metals, formed in the shape of lenses of different sizes and degrees of thickness.

From these he derived encouraging but not convincing confirmation of the correctness of his theory.

Continuing his tests he at last found that a plano-convex disc gave the greatest increase to the electric current, and he grasped the idea of "continuous refraction," and determined to try what its resultant force would be with a "cone" introduced into the experiment. The result was simply startling, the increased strength given to the current transcending his wildest expectations. He then began a series of tests, using all the metals adapted to the transmission of the electric fluid, with a view to find that particular one most favorable for his purpose. Those who are aware of the rarity and costly character of many of these metals can form some idea of the amount of patience and perseverance required by, as well as the expense involved in, such an experimental investigation.

Mr. Connolly devoted nearly every dollar of his hard earned though lucrative salary for many years to the working out to a practical solution of his wonderful conception.

After repeated and careful tests, going over and over again and noting the result of each experiment, Mr. Connolly found that the metal palladium gives nearly five times the effect that can be obtained from any other. He also found that it was necessary to use a solid cone, but that a hollow one with a very thin shell was, if anything, better still.

Palladium, being one of the ductile metals, can be readily shaped as desired, and, as it is very rare and costly, a great saving is thus made through this latter discovery; and being a metal possessing the greatest refractive power known, all danger of its being

fused by the powerful current generated is obviated. After numerous careful measurements, the young experimenter found that by the use of palladium the strength of the electric current is increased in direct ratio as the square of the increase of the radius, less the difference between the hypothenuse and perpendicular of a section of the cone, when the angles of the latter are at forty-five degrees from the center, that angle giving the best results. He also found that a series of "multipliers," as he has named his invention, can be used, each one taking the increased current, and again multiplying it. As the smaller end of the cone need not be over the 100th of an inch in diameter, a slight calculation will show what prodigious effects may be produced with two or three half-inch multipliers placed in the current of an ordinary electro-galvanic battery. Mr. Connolly's experiments have been made with very small multipliers, but with them he has been able to work one of the largest wires running from the Fort Worth office, using only two cells of an ordinary gravity battery. This was done unknown to the operators in the office, and so strong was the current generated that it was noted by all the men working on that line. With the use of only two multipliers placed in the circuit from one of the line batteries, an iron rod half an inch thick was heated red hot.

A little reflection will give some faint idea of the importance of Mr. Connolly's discovery, although it is impossible now to foresee the grand results which, through its means, inventive genius will achieve. By its aid the great expense to telegraph companies of keeping up large batteries on each line operated will be almost entirely removed—a single cup taking the place of a hundred.

By placing the multipliers in a line, say two hundred miles aparts, a single current can be worked from New York to San Francisco as easily as one now is from Houston to Denison.

By the employment of Mr. Connolly's invention, a diminutive gas engine would supply all the motive power necessary for the electric lights of the entire city of Houston.

An ordinary sized Faure accumulator, or storage battery, with Mr. Connolly's multiplier attached, would run a street car for half a day; and with improved electro-motors, it might be applied to locomotives and used in moving railway trains. In fact, it is a work of supererogation to speculate upon the benefits which will probably result from this remarkable discovery; a discovery so remarkable that a simple statement of the facts in relation thereto sounds like a story from the Arabian Nights.

There is a corrollary to Mr. Connolly's discovery which he has not yet had time to push to a definite conclusion. He has found that by reversing his multiplier a similar effect is produced on the strength of the current, as takes place in the magnifying powers of a telescope when the larger end of the instrument is applied to the eye—the electric current in the one instance being decreased just as in the other the waves of light are contracted. It is his firm belief that by the application of this principle to lightning-rods the most powerful current of lightning may be rendered perfectly harmless, and there would seem to be no scientific reason for doubting the correctness of his theory. Mr. Connolly has conducted his experiments very quietly, admitting but two friends to his confidence during their progress, and has as quietly protected himself by letters patent. He contemplates going to Chicago in the next few days for the purpose of making arrangements for the manufacture of his "multipliers," and for their introduction into actual use. It is his intention before returning to Texas to visit New York, and he expects to arrange with the Western Union and other telegraph companies, and the various electric light companies, for the introduction of his invention into their offices. After this he will probably visit the various European capitals, and sell his invention to the various foreign governments. Mr. Connolly has made hosts of friends wherever he has been, by his great personal magnetism, and to these his success will come as "good tidings of great joy."

Pyro-Electric Properties of Boracite.

The optical, thermic, and pyro-electric properties of boracite have been the subjects of a series of investigations by Hauy, Hankel, Mallard, Baumhauer, and others. Herr Mack has recently made researches based upon an observation of Kundt that Lichtenberg's figures can be used for an examination of the pyro-electric properties of crystals. A description of his experiments appeared in *Wiedemann's Annalen*, Vol. XXI., pp. 410 to 421, and the following abstract is given in the Chemical Society's *Journal* for June: "The method of observation consisted in heating the crystal to be examined in an air bath, removing it by a pair of pincers previously heated in the same bath. The crystal is then passed through an alcohol flame and placed on a slip of wood or paper, where it is dusted thoroughly with the ordinary mixture of sulphur and red lead. On cooling, the particles of these substances arrange themselves in definite lines, thus marking out the field of positive and negative electricity. The crystals examined were cubical, rhombic, dodecahedral, and tetrahedral, obtained from Stassfurt and Luneberg. The general results of the investigation may be summed up as follows: 1. The difference of potential, whether positive or negative, does not extend over the whole surface of a crystal, but follows certain definite lines. 2. If upon a crystal in which either the rhombic or dodecahedral form is dominant, there be conceived to be marked out a smaller, perfect rhombic dodecahedron, so that its principal crystallographic axes coincide with those of one or other of the above crystals, and there be projected from the common middle point, the angle of the latter dodecahedron upon the surface of the crystal, then a system of lines is obtained, coinciding with the lines of the electro-positive or negative potential differences. Those lines which connect the middle points of smooth and glistening tetrahedral surfaces are colored yellow, but those which lie symmetrically to any principal symmetrical plans of the regular system are red. This system of lines coincides with the optical system of lines of double refraction which have been described by Klein and Baumhauer. It would appear, then, that there is an intimate connection between the optical and pyro-electric properties of boracite. The former are probably conditioned by a state of tension of crystal, and the experiments of T. and P. Currie would seem to point to the same conditioning of the pyro-electricities.

Secondary Batteries.

The great interest which the introduction of the Faure secondary battery awakened a few years since is somewhat remarkable when viewed in the light of previous researches into the phenomena attending the development of voltaic electricity. Within a few months of Volta's announcement of the effects produced by his "pile," and more especially by his *couronne de tasses*, the first of the voltaic batteries consisting of cells containing a fluid and two metals, it was discovered that a voltaic current could be developed by acting upon the opposite sides of the same metal with different fluids; and that on passing a current through a liquid decomposable by that current flowing between pieces of the same metal immersed in the liquid, a reverse current was obtained when the battery was removed, and the ends of the two pieces of metal outside the liquid were brought into contact.

No one seems to have had any idea of utilizing this secondary current until Grove constructed his gas battery in 1840, and Plante, taking up the subject, brought out his secondary battery some twenty years later. Indeed, the attention which the secondary current did receive was chiefly with a view to ascertaining its cause and effect in the hope of eliminating from primary batteries themselves those features which caused a wasteful expenditure of the materials used, and of the current generated. Moreover, it was not until the question of electric lighting was receiving great attention, and the magneto-electric current was found to give a somewhat unsteady light, that electricians thought that the secondary battery might be used with the electric current, to effect a similar purpose to that fulfilled by the hydraulic accumulator in the case of water of high pressure. They sought, by using the electric current, to cause variations in the chemical condition of the surfaces of extended electrodes, to store a power which could be reconverted into an electric current, when, and as required, by the utilization of the secondary current, which could be developed when the surfaces of the extended electrodes were allowed to return to their normal condition.

It will thus be obvious that the effects attending modern secondary batteries will be better understood after an inquiry into the researches above alluded to. That inquiry, however, cannot avoid the subject of primary batteries; for the secondary battery is simply one in which the surfaces of two solids immersed in liquid are subject to unlike chemical conditions. The only difference between the secondary battery and the many similar primary circuits described by Sir Humphrey Davy eighty years ago, is that the unlike chemical conditions, instead of being obtained from ordinary sources, are brought about by electro-chemical deposit. To note the close relation between primary and secondary batteries will, moreover, not merely be of interest to the electrician, but will assist the student to a better comprehension of the subject.

The accidental discovery by Galvani in 1790 that the muscles of dead frogs were convulsed on the discharge of an electrical machine, near which the frogs were lying, led him, after various experiments, which need not here be referred to, to believe that the muscles were negatively and the nerves positively electrified, and that metallic contact restored the equilibrium by discharge. Volta took up the question, and came to the conclusion that the electricity was generated at the point of contact of the metal with the animal tissue; and he showed that similar contractions to those observed by Galvani could be caused by making contact between two muscles or two nerves, or between two parts of the same muscle or nerve; but he found that to produce this effect two different metals were required.

The cases noted by Galvani are examples of a current set up in a circuit consisting of one metal and two different fluids, or of a metal and a fluid in two different conditions at different places; the one fluid contained in the tissue of the nerves, the other in the tissue of the muscles. In the cases noted by Volta, where a nerve or a muscle and two metals were used, obviously the circuit was, like that of the voltaic pile, developed from those experiments, one which consisted of two metals and the one fluid contained in the muscle or the nerve, whichever was used.

Volta considered his pile similar, in the relation of its parts, to the natural organ of the torpedo and of the electric eel, because it was composed entirely of conductors of electricity, contained its own exciting force without the necessity of being charged with electricity from a machine, as was requisite in a case of a battery of Leyden jars (for at that time the frictional electrical machine was the only artificial source of electricity), and because it was capable of giving a continuous current, and of giving shocks, more or less strong as desired, which were similar in their effect upon the body of the experimenter to those of the above-mentioned creatures.

From his description, it would appear that he frequently used coins for forming his piles in the early experiments, and that generally his piles were constructed with pieces of metal about an inch in diameter. He used discs of cardboard, skin, or some other material of a spongy nature, capable of absorbing moisture, to place between the pairs of metal discs; and he mentions that in order to be successful in an experiment it was necessary that these discs should be well soaked. They were also made a trifle smaller than the metal discs.

Having prepared a sufficient number of these discs, the metal ones well cleaned and dry, and the others well soaked in pure water, or, what he found better, salt water, and afterwards slightly wiped dry, so that the moisture might not be squeezed out and run over the edges of the metal discs when a pile of many sets was formed; he placed a disc, say, of silver, as the base of the pile, then one of zinc, then a moist one, then a silver one, then a zinc one, and so on. When he desired to make up a very large pile of sixty or more sets, he considered it best to divide the pile into columns of about twenty sets, connecting the base of one column with the top of the next. These piles are illustrated in Figs. 1 and 2.

Fig. 1. Fig. 2.

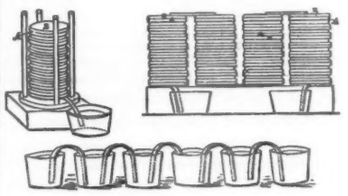


Fig. 3.

His *couronne de tasses*, which he devised as being able to give a current of much longer duration and regularity than the pile, was simply a series of glasses to contain the water, into each of which were placed the different ends of two arcs, each formed of two metals. It is illustrated in Fig. 3. These three illustrations are from sketches taken from the engraving accompanying Volta's letter to Sir Joseph Banks, President of the Royal Society, as published in Philosophical Transactions, 1880. Fig. 1 represents a pile of a single column; Fig. 2, one of four columns. In all three illustrations the discs or plates, marked *A*, are of silver or copper; those marked *Z* are of zinc, tin or lead. Zinc and silver gave the strongest current. The basins of water, into which the terminals were taken, were used for the convenience of making contact with the whole of the hand of the experimenter. The dry finger point was found not to make so effective a contact as was obtained when the skin was moistened.

Carlisle and Nicholson, in 1800, and Ritter, of Jena, somewhat later, succeeded in decomposing water by means of the voltaic currents; and Ritter, in experiments with other electrolytes, noticed the deposition of metal on the electrodes, and observed that on disconnecting the battery and connecting the electrodes by a wire outside the fluid electrolyte a current was obtained in the reverse direction, and that the electrodes retained their power of giving this reverse current on replacement after being removed from the electrolyte and dried. Ritter's secondary pile consisted of discs of copper alternated with discs of cloth moistened with solution of ammonium chloride (sal-ammoniac).

It was remarked by Sir Humphrey Davy in 1801 that all galvanic combinations similar to Volta's, which had then been described by experimentalists, consisted, so far as he knew, of two metals or of one metal and charcoal; and that it was supposed that their agency was in some measure connected with the different powers of the metals to conduct electricity. But he says that he found an accumulation of galvanic influence, exactly similar to the accumulation in Volta's pile, might be produced by the arrangement of single metallic plates, or arcs of one metal with different strata of fluids. The reasoning which led to this discovery was brought about by observations connected with the phenomena accompanying the chemical changes in which there is evolution of galvanic energy. He found that series of double plates, properly arranged, but incapable of galvanic action with water as the medium in which the intervening felt or flannel had been soaked, were capable of such action on being alternated with acids or fluids capable of oxidizing one of the metals only. He mentions that silver and gold gave a current with cloths moistened with nitric acid, and that copper and silver also gave a current with cloths moistened with mercuric nitrate. This led him to suppose that the alternation

of two metals was only necessary in so far as it supplied two surfaces capable of different degrees of oxidation, and that single plates would do if they were arranged so that they were connected by different fluids in such way that only one side was oxidized. In carrying on his experiments, he found that galvanic action was produced not only when oxidation, but when other chemical changes occurred. He divides the galvanic combinations thus obtained into three classes:

The most feeble; when single plates or arcs are arranged so that the two surfaces, or the opposite ends, are in contact with different fluids, the one capable of oxidizing the metal, the other not so; and he says that tin, zinc, and some other easily oxidized substances are best in this class. He gives as an example a pile consisting of pieces of tin 1 inch square, $\frac{1}{10}$ inch thick, separated by woollen cloths of

Fig. 4.

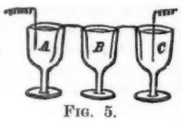


Fig. 5.

the same size moistened, some in water and some in dilute acid, and arranged in the following order: Tin, acid, water, tin, acid, water and so on, one above the other. Twenty sets formed a feeble battery. He remarks that the acid cloth being placed below the one moistened with water, little mixture of the acid and water occurred.

The second class of these combinations with plates of one material was formed of metals or metallic substances that acted on sulphuretted hydrogen, or on sulphides dissolved in water, arranged in series with portions of a solution of potassium sulphide in water, in such way that one side of a plate, or one end of an arc, was in contact with potassium sulphide solution, and the other side or end with water. Silver, copper and lead were all found suitable metals; and plates of either of these metals were arranged thus: Metal, cloth moistened in solution of potassium sulphide, cloth moistened in water, metal and so on. The action with copper proved greater than with silver, and that with silver greater than that with lead.

The third class of these combinations comprised metals which were oxidizable by acids, and which were also capable of acting on solutions of sulphides, the metal being arranged so that opposite sides underwent different chemical actions. These piles were best arranged with three cloths between each pair of metals, the cloth moistened with dilute acid being separated from that moistened with solution of potassium sulphide by a cloth moistened with water only.

In piles constructed in any of these three ways the action is transient, owing to both the acid and the solution of sulphide being quickly spent. Count Rumford suggested a box divided into cells by alternate sheets of metal and horn, or other non-conductor.

Fig. 4 shows part of such a box, in which *a* represents the metal plates, *b* the oxidizing solution, *c* the solution of sulphide, *d* strips of cloth connecting the cells separated by the non-conducting material. Fifty metal plates with weak nitrous acid, or ammonium nitrate on one side, and with solution of sulphide of potassium on the other, gave a tolerably strong current.

Davy's experiments with electricity, as a chemical agent in the reduction of the metals of the alkalies, gave him opportunities of noticing the phenomena of electrolysis, and in the Bakerian lecture, 1807, he mentioned that when a solution of salt is decomposed by the electric current the base always passes to the negative and the acid to the positive electrode. If three glasses, *A*, *B*, *C*, Fig. 5, be taken, and *A* be filled with distilled water, *B* with weak solution of litmus, and *C* with solution of potassium sulphate, and the solutions in the glasses are connected by moistened threads *D*, as shown; then, on passing a current from *A* to *C*, the presence of acid was detected at the point where the thread moistened with litmus came into contact with the solution in *A*. On changing the glass *B* and the moistened threads for others containing solution of turmeric, the alkaline reaction was first observed where the thread moistened with turmeric came into contact with the solution in *C*. This showed that the sulphur compound did not pass from *C* through *B* in the form of sulphuric acid. Again, if the solution of potassium sulphate was placed in *A* and the water in *C*, the current passing the same way as in the former case, the potassium compound was passed through *B* to *C* without affecting the turmeric solution in *B*, the acid remaining in *A*. The presence of acid and alkali being respectively noted at the point of contact of the threads with the solutions in *A* and *C*.

Grothüss, supposing that in every binary compound or similar body one of the atoms or radicals is electro-positive, and the other electro-negative, suggested that there is a successive combination, disruption and recombination of the molecules from electrode to electrode, and that atoms or radicals are left free next the electrodes because there they find no free opposite atom or radical with which to combine. It seems impossible that this could occur in the case noted above, for in that case the free acid and alkali ought both to have first shown themselves where Davy expected to see them—in the vessel containing the solution of potassium sulphate; for, if the decomposition is first effected at the electrode in the vessel *A* containing the solution of sulphate, and it is necessary for the sulphur compound set free to effect a recombination with the potassium compound of an adjacent molecule of sulphate of potassium, then it must be equally necessary for the sulphur compound, on reaching the thread between the vessels *A* and *B*, to find some substitute, and as sulphuric anhydride, which would probably be the form of the sulphur compound, readily combines with water to form sulphuric acid, nothing could be more natural than Davy's expectation to find the acid manifest its presence at the junction of the thread with the solution in *A*.

Another theory is that such a compound as potassium sulphate is split up into metallic sodium and a compound of sulphur and oxygen, which compound goes to the positive electrode; that the potassium decomposes water, becoming caustic potash and liberating hydrogen; while the sulphur and oxygen, on reaching the positive electrode, also decompose water, becoming sulphuric acid and liberating oxygen.

It is, however, only necessary to suppose that, whichever atom or radical has to travel across the electrolyte to the opposite electrode is in a state in which it cannot combine with anything, having reached the electrode which formed the terminus of its journey, it then becomes able to combine and manifest acid or alkaline properties.

Clausius objected to the first-mentioned theory on the ground that there would be a great expenditure of energy in causing the repeated decompositions, and supposed that the molecules of liquids were naturally in a state of constant decomposition into their elementary constituents, and of constant recombination, and that the passage of the voltaic currents simply classified the free atoms and took them respectively to the negative and positive electrodes. There is, however, no need for this supposition if it be assumed that the atom or radical which has to traverse the electrolyte is in a state of disability to combine with anything until it has fulfilled its mission.

It will be seen from the foregoing remarks that philosophers were, and for that matter still are, divided in opinion as to the origin and method of the voltaic current. On the one hand, the origin was traced to the point of contact of different metals in a circuit consisting of two metals and a fluid; on the other, the chemical action that took place at the point of contact of dissimilar substances, whether metal or liquid, was asserted to be the cause of the current set up.—*Thomas Wilkins, in Engineering.*

The nationality of the soldiers in the Union army during the rebellion is given as follows: Native American, 1,500,000, or 75 per cent.; British American, 54,000, or 2¾ per cent.; English, 45,000, or 2¼ per cent.; Irish, 145,000, or 7⅛ per cent.; German, 176,000, or 8¾ per cent.; other foreigners, 75,000, or 3¾ per cent.

Emery Mines and Exports.

Our consul at Smyrna writes to the State Department as follows:

As no inconsiderable part of the annual product of the emery mines of this province is exported to the United States, as it is the sixth article in point of value thus exported, some facts bearing upon this production may not come amiss. For many years one or two parties holding concessions from the Government maintained a virtual monopoly of the emery-mining industry, and kept up prices accordingly, the rough stone being sold at the rate of £16 sterling per ton. To-day, £5 sterling per ton is an average price. How much of this falling off in price is due to competition, deterioration, or decrease of consumption, can only be estimated. The mines are worked either under "firmans" or concessions, obtained from the Government only with difficulty and large expense, or through contracts made with the "estates of the Church Ottoman," known as "vacouf." In the latter category are the mines of "Gumnah Dagh," near Sokia, and about four hours distant from the station of Azizie, on the line of the Ottoman Railway, which station is about seven miles from Ephesus. These mines pay to the "vacouf" a royalty of so much per ton on all the ore extracted, which is transported on mules and donkeys to the station at Azizie, and taken thence to Smyrna by rail. The road from the mines to the station being very rough and over mountains, camels cannot be employed, a serious drawback, inasmuch as the carrying capacity of a mule is only equal to about one-ninth of a ton. The quantity of emery yet unmined in these quarries of the Gumnah Dagh is large, but the quality is below the standard. The Thyra mines, known as the aliogoli, are located on a range of hills between Cosbunar and Thyra, within four and one-half hours by camel from Cosbunar to station on Ottoman Railway, forty miles from Smyrna. They are operated by several parties under concessions from the Turkish Government, for a term of ninety-nine years. Formerly large quantities of excellent emery were taken out, but of late years it has become difficult to extract the ore, which is conveyed on the backs of donkeys to the plain. At the foot of this range of hills is the Coursak mine, a large, irregular bed of emery, not a lode mixed with earth. It is easy of extraction, no powder being required, but is covered with from fifteen to twenty-five feet of silt, the accumulation of ages. Much of this inferior quality of stone finds a market in Germany and the United States. In all emery deposits there is a risk of a sudden exhaustion of the ore. This fact, taken in connection with the difficulty of procuring concessions, the peculiarities of Turkish laws and the export duty of twenty per cent., calculated at the selling price in Europe, does not encourage enterprise in the direction of opening up new mines or deepening old ones, although experience proves that the best emery comes from the greatest depths.

Old Cable Stories Retold.

By F. C. Webb.

THE UNARMORED LINE FROM DOVER TO CAPE GRISNEZ.

"Come, get up, Mr. Webb, here's the 'lectric talegraph in the harbor." Thus I was aroused by Captain F. Bullock's old one-eyed steward on board H. M. S. Widgeon in Dover harbor on the morning of August 25, 1850. I hardly knew then what the "'lectric talegraph" meant, and was soon up and prying about on the quays of Dover harbor till I found a London tug with a great reel of smooth, brown-looking stuff across her deck just abaft the funnel. I was only a visitor on board the Widgeon, but some help being asked from Captain Bullock, Lieut. Burstal (now Capt. Burstal, secretary of the Thames Conservancy Board) was sent with some dozen men on board the Goliath (tug) to render any assistance required, and I accompanied them.

The first attempt at a submarine telegraph across the straits was about to be made. The wire was simply a copper wire, insulated with a single covering of gutta percha to a thickness of about half an inch. It was wound on a reel extending across the deck. A cast-iron reel had at first been supplied, but this was so ponderous and heavy that a spar of wood, with cast-iron ends, was prepared by the late Mr. W. Reid, who was employed by Mr. Wollaston, the engineer in charge on the work. To sink the line and moor it, flat, leaden weights, with a groove running diagonally across them, were prepared, so that they could be easily riveted on to the wire. Half the number had two holes in them, and the other half were cast with projecting studs of a size to fit the holes and project a little through. A blow with a hammer on each projecting stud thus riveted them quickly and securely. Some softened gutta percha was placed in the groove to give the wire better protection from the edges of the metal. For shore end the wire was encased in lead.

We went outside the harbor, and the tug anchored close off the works of the Admiralty Pier, then only just begun. There were on board Mr. Wollaston (in charge), Mr. Crampton (a visitor), Mr. H. Brett, the concessionaire, and some other gentlemen. The lead-covered wire was already down the pier, and the end from the tug was joined on to the primitive shore end in a boat. I can well recollect Mr. William Reid (better known by telegraph engineers of that day as "old Reid") standing up in the boat with a soldering iron in his hand, with which he had done something to the lead-covered wire. As soon as we started there was a difficulty in finding a convenient place for riveting the weights together on. I suggested shipping the hawser bridge. This was done, and a workman sat astraddle across it, and had a good place to rivet the lead weights on. At first we stopped altogether to rivet the weights, but after a little while we collected some slack near the taffrail, and then only slowed down and eased the slack over, during which time the weights were being riveted. There was a break on the drum, and at the stern our men from the Widgeon had some wet canvas and held this round the wire. Little Mr. Brett came fussing about our men with such impracticable orders that at last they deliberately entangled him in the loose slack, so that he did not come there again. I have no knowledge of the distances the weights were apart, but probably they numbered about sixteen or twenty to the mile. I know that a gentleman (I think a Mr. Wollaston, and relative of Mr. Wollaston, the engineer in charge) gave the time to ease down with a whistle. The ship was then eased, a man ran along with a piece of warm gutta percha, clapped it on the lower weight, the wire was pressed into it, another piece put on top and the top weight put on, two blows given on the projecting studs, and the weight was handed along as the wire slowly paid out again. On the taffrail was a little wooden roller, but no guide of any kind to keep the line on it.

When we got off Cape Grisnez we anchored, and a type-printing instrument was put in circuit in the cabin. The instrument began to print off a jumble of letters, and Mr. Brett tore the slip up, although it was a record of the first signals across the straits. This so incensed Mr. Wollaston that I thought he was going to box Mr. Brett's ears. Being of an archæological turn of mind, I saved a piece and carefully pasted it on paper and labeled it. Captain Bullock requested it of me, and I of course gave it to him, and he presented it to the old Duke of Wellington, then staying at Walmer Castle. We joined our own ship, the Widgeon, soon after this, and did not see the landing of the Grisnez end.

This was my first connection in any way with telegraphy. Of those that were on board, Mr. Wollaston, Mr. Crampton, Capt. Burstal, Mr. Willoughby Smith and myself are alive. Mr. Brett died some years ago.

The line was laid to save the concession, which required that telegraphic communication across the straits should be made before a certain date. The wire answered this purpose, but was cut the day after it was laid by a fisherman, who hooked it up off Cape Grisnez and cut it through with a knife. Dr. Russell, in his work on the Atlantic cable, in alluding to the incident, calls this fisherman a "*pescatore ignoble.*"—*London Electrician.*

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We invite correspondence from Electricians, Inventors and the Telegraph and Telephone fraternity on matters pertaining to electrical and scientific subjects, and all facts of special interest in connection therewith.

We extend to manufacturers of electrical apparatus an invitation to send to this office any and all facts concerning their business which will be of interest to the public. We make no charge for publishing news.

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The proposal to hold the next meeting of the National Telephone Association in Philadelphia, instead of Providence, as originally proposed, meets with general favor, in view of the fact that the electrical exhibition will be open at that time. The gathering of electrical people promises to be very large, and the opportunity will be afforded of meeting prominent electricians from all over the country, with a liberal sprinkling of notabilities from abroad.

New York is steadily increasing the number of electric lights for street illumination. At their meeting on Monday of this week, the Aldermen voted to substitute electric lights for gas in Houston Street, from river to river; in Grand Street, from Sixth to Eighth Avenue; in Centre Street, from Chambers to Broome; and in several other localities. The authorities find that it is quite as important to light the cross streets as the main avenues, and that, as a means of protecting life and property, electric lights, which are a constant terror to evil-doers, are an excellent investment.

According to the Waterbury *American*, the endeavor to "boycott" the telephone in Stamford didn't work, owing to the failure of the "boycotters" to keep faith with one another. Just as soon as one of them took the telephone back, all the others followed suit, greatly to the convenience of their customers and to the satisfaction of the telephone management. The marketmen and grocers of Stamford are now satisfied that the telephone has "come to stay," and that it has got to be recognized, not as a luxury, but as a necessary adjunct of business. Perhaps they are right in one sense in saying that it does not "pay," but they have demonstrated to their satisfaction that trying to get along without it is costly business, because injurious to trade. Men who "kick" against improvements invariably come to them in time, and the "kicking" injures no one but themselves.

The rival telegraph combinations are evidently getting into shape for active competition, and long-distance telegraphing promises to get down to figures that will make it attractive to everybody. If the competing companies do not carry the thing too far, the result will be of advantage to all concerned—the public and the companies. As we have before said, the fact is that the public—the great uncommercial public—is only just beginning to use the telegraph freely. A reduction of rates will increase both the length and the number of telegrams, the wires will be loaded up to their capacity, and the treasuries of the rival combinations will be benefited. This may seem a strange prediction, but wait and see if the event does not sustain it.

The following excellent suggestion we find in *Science:* "The is a fine opportunity to make the coming electric exhibition in Philadelphia a public educator as well as a brilliant display by giving due care to the explanation of the different groups of exhibits. Only a very small share of the visitors to such exhibitions understand what they see; but by far the greater number would gladly learn more than they know if the way were open. The untaught majority of the visitors may wonder and admire, but they really learn very little. Their curiosity is excited, but their reason is not satisfied. Printed explanations are seldom given; verbal explanations are often too technical to be of much value, even when the exhibitors can be found, and are willing to tell their story for the hundredth time." We take the liberty of commending this suggestion to the managers of the exhibition, with the further suggestion that they bring it to the attention of exhibitors.

It is an old saying that the way to make money is to buy low and sell high, and the fair deduction from this is that the time to buy is when things are low. Of course, it takes nerve and courage, but we have always noticed that it is the folks that possess those characteristics that win. If these ever was a time when electrical securities were low, it is *now*. Many of them, of course, are deservedly so, and are bringing all they are worth; but there are others which have been dragged far below their intrinsic value, and they are bound to come up. It is for every one to investigate for himself, and separate the sheep from the goats. We certainly shall not undertake to do it for any one. But we feel perfectly safe in predicting that within six months a good many folks that think their perceptions are of fair quality will be kicking themselves vigorously for not having been bright enough to pick up some of the good things which are just now going a-begging.

Texas is in a fair way to have cheap telegraphy, as an important contract has been executed between the Baltimore and Ohio Telegraph Company and the Gulf, Colorado and Santa Fe Railway Company, which will open up for competition nearly the entire State. The Gulf, Colorado and Santa Fe Railway Company have wires already in operation between Galveston, Houston, San Antonio, Austin, Dallas, Fort Worth, and other important towns, which will be connected within two or three weeks with the Baltimore and Ohio Company's lines, already in operation to Texarcana. The prospects of competition are gladly welcomed by the citizens of Texas generally. The necessary material—poles, wire, etc.—have already been shipped to construct the lines from Texarcana to Paris, and from New Orleans to Houston, it being the purpose of the Baltimore and Ohio Telegraph Company to give the State of Texas two outlets to the North and East. Hitherto the tariff to points in Texas have been very high, and business has been restricted in volume. But now that a competing line comes in there will result more reasonable rates, better public accommodation, and a large increase in business. No State in the Union is showing more growth and progress just now than Texas, and this move on the part of the new telegraph combination opens up a country that is destined to contribute very liberally to telegraph receipts.

AN IMPORTANT DECISION.

The Brush Electric Light Company has met with defeat in its suit against the United States Electric Light Company. This suit was begun on December 3, 1880, and has now been pending nearly four years. The defendants of record, Messrs. Condit, Hanson and Van Winkle, were at that time the selling agents of the Weston Electric Light Company, and the suit was brought to restrain them from selling arc lamps of the Weston system and the Weston copper-coated carbons. The defense of the suit was assumed by the United States Co., which succeeded to the business of the Weston Co. Various other suits have been brought by the Brush Company against those using the Weston arc system, and this was made a test case, and was tried with the greatest care and elaboration on both sides. The testimony, exhibits and briefs cover over 2,500 printed pages, the complainant's brief alone covering 448 pages, and there was also a large number of arc lamps and models put in evidence. The case was argued before Judge Shipman at Hartford, in March last, by consent of counsel, and the oral arguments occupied eight entire days. Both the patents upon which the suit was brought were at the outset extremely broad in their terms, and, if they could have been sustained with a liberal construction, would probably have gone far towards establishing for the Brush Company a monopoly of electric arc lighting. Two disclaimers were filed by the Brush Company during the suit, by which part of the claims of the patent on arc lamps were abandoned and the remaining claims materially restricted, and Judge Shipman now decides that the patent is void. So strong a case was made out in the matter of the copper-coated carbons that the complainants withdrew that patent from the suit, thereby virtually abandoning it. It may be added, for the exact information of our readers, that the carbon patent thus withdrawn and abandoned was the one granted October 23, 1877, and that the case of the complainants, so far as the lamp was concerned, rested on the eight claims of the patent issued May 7, 1878, and reissued May 20, 1879, and known as the "clamp patent."

The case of the clamp patent turned upon the claim of prior invention and use. The summing up by the judge, at the close of his opinion, is particularly interesting. He says: "The case is that of the well-known practical use in ordinary work, with as much success as was reasonable to expect at that stage in the development of the mechanism belonging to electric arc lighting, of the exact invention which was subsequently made by the patentee, and although only only one clamp and one lamp wire were ever made, which were used—two and one-half months together only—and the invention was then taken from the lamp, and was not afterwards used with carbon pencils, it was an anticipation of the patent device under the established rules upon the subject. With a strong disinclination to permit the remains of old experiments to destroy the pecuniary value of a patent for a useful and successful invention, and remembering that the defendants must assume a weighty burden of proof, I am clearly of the opinion that the patentee's invention has been anticipated by that of Hayes."

Arc Lights Without Carbons.

To the Editors of the Electrical Review:

Has the progress made in bringing the electric arc lamp to its present state of perfection been slow or rapid? When we consider the early date at which the first experiments were made, we cannot but conclude that, on the whole, the advance has been but slow. True it is that the real advance—the improvements made whereby the lamp has been made practicable and permitted to come into general use—has been within a comparative few years. But, beyond the adoption of ingenious mechanical devices for the automatic working of the lamp, no important step has been made since the earliest discoveries. The use of the carbon pencils is of early date, and upon their use has been based the improvements in the mechanical devices for their proper manipulation. The wasting away of these pencils in the intense heat of the electric current widens the space between them to such an extent as to interrupt the current in its passage from point to point, and this naturally suggested the adoption of some means by which these points might be made approach one another sufficient to admit of the uninterrupted passage of the electric current. Hence, the various devices for that purpose now in use.

From the mere mechanical field the inventor must depart, and seek for some new principle whereby the arc lamp may be made less expensive, and independent of the care necessary to keep it in such condition as to be useful. It seems to me that one point, and one which necessarily involves a most important principle in the arc lamp, and one to which electricians might with profit direct their thoughts, has not been the subject of such investigation and experiment as the possibilities of success warrants—to wit, the abandonment of the carbon pencils. Can this be done, and the practicability of the lamp retained? To this question it will, no doubt, at once be said, the air space between two points through which the electric current will pass has been demonstrated to be so short that, if any substance possessing the qualities of a conductor and of such value as to make its use universal, be placed at those points, the heat within the circle of the arc will fuse that substance. There is no question as to this, and, since it has been found that the carbon now used for these points is the best-known substance for the purpose, how, then, can their use be dispensed with?

That the carbon from which the points are now made is the best-known substance for the purpose is admitted, but my suggestion goes beyond this, and leads to the further inquiry as to whether or not carbon, in a solidified form, cannot be dispensed with in the use of the arc lamp, and some means adopted whereby the current of electricity may be assisted in its passage through an air space sufficiently great to admit of the points being placed without the arc and free from its intense heat, and being so placed may be composed of some hard, inexpensive material capable of conducting a current of electricity.

As it is not thee purpos of the writer at this time to go into a discussion of the questions here suggested, but simply to place the subject before your readers in such a way as to admit of an intelligible expression of the thoughts of those who may think it of sufficient importance to do so, and whose views, I trust, will find a place in your columns, I defer the further discussion of the matter until a later day, when I hope to be able to give, through your columns, the results of my experiments in the line of the above suggestions.

J. W.

Electric Lights in Hartford.

The principal ownership in the capital stock of the Hartford Electric Light Company, hitherto owned by the American Electric and Illuminating Company, of Boston, by whom the plant was built, has passed into the hands of a strong financial syndicate, composed of Hon. Wm. H. Bulkeley, Lieut.-Governor of the State; Hon. Morgan G. Bulkeley, President Ætna Insurance Company and Mayor of Hartford; Thos. O. Enders, President of the United States Bank; Austin C. Dunham, Vice-President Willimantic Linen Company; Wm. A. Healy, President of the Pratt & Whitney Machine Company; Judge George S. Gilman, Connecticut Mutual Life Insurance Company; and Charles H. Owens, attorney-at-law. The

sale has been under negotiation for the past three months, and the papers were finally executed on Monday by the syndicate and President Goff of the American Company.

Illumination of Passenger Cars.

A large party of representative railroad men from all parts of the country met at Altoona, Pa., last week, in the yards of the Pennsylvania Railroad, where a train of eight passenger cars was in position, each one having a different kind of light. The first car was illuminated by ordinary coal gas; the second by the same quality of gas, with gasoline added to enrich the flame: in the third car the Lipsey burner, using the same enriched gas as the second car was used. The globe of this burner throws the light down, as well as a very considerable amount of heat, and looked like a Siemens' burner upside down. The illumination, however, was very good; in the fourth car the Siemens' burner was tried, supplied with the same kind of gas, but, owing to the location of the burners on the lamps, it threw a very distinct shadow on the floor of the car and on the seats. The fifth car was lighted with the oil-gas system used by the Philadelphia and Reading road for several years. The light was about the same as the ordinary gas-light. The seventh car had a gas made from gasoline, using an Argand burner, which made a beautiful light, and which is promised to be perfect on the application of several new principles by its owners. The last car was beautifully illuminated by the Brush electric light from a storage battery. The simplicity of the whole lighting apparatus, together with the excellence of the light, made the electric display the best of all. The gasoline used was rendered perfectly safe, in the event of accident, by its application.

Dr. Dudley, the chemist of the Pennsylvania Railroad, gave an interesting lecture on the several lights used, and said that the electric light was the coming light for railroad use as soon as the subtle fluid could be generated as fast as exhausted. The doctor was kept busy answering the numerous questions from all sides on the durability and strength of the different lights.

Electric Lighting for Dances.

Two dances recently given in London, says the *Electrician*, were much enhanced by the rooms being lighted by incandescent lamps. Although both evenings were extremely hot, the rooms, as usual when lighted by the electric light, were not nearly so close as when lighted by gas on a cool evening. The following particulars may be of interest:

The size of the dining room was 27 feet by 16 feet, by 13 feet high; this being merely a refreshment room was underlighted, except at the extreme end over the table, where there were two 20 and one 10 candle power lamps. At the other end of the room there was only one 20 candle-power lamp. The drawing room, where the dancing took place, was 34 feet by 19 feet, by 13 feet high; this room was brilliantly lighted. There were twelve 10 candle-power lamps in the center chandelier, three 20 candle power lamps hanging from pendants in the center of each window, one on a statue underneath, and one 20 candle-power lamp at the further end lighting up the conservatory as well as one end of the room. One 20 candle-power lamp was arranged under water in the conservatory. The hall was well lighted by one 20 candle-power lamp in front, and one 10 candle-power lamp behind, the size being 32 feet by 7 feet, by 10 feet high. The supper-room upstairs, 27 feet by 16 feet, by 10 feet 6 inches high, was very brilliantly lighted with six 20 candle-power lamps hung as pendants, with small globes. The lamps being of the new Woodhouse and Rawson type, took very little current. From 9:30 to 12 o'clock—that is before the supper room was lighted—15 amperes were required; from 12 to 2:30, 21 amperes; from 2:30 to 3:50, 15½ amperes. On the second night the current was slightly in excess of this, there being more cells switched on. Thirty-one horse-power Faure-Sellon-Volckmar cells were used, and the total number of ampere hours taken out of them was 252. The lamps were running somewhat over 20 and 10 candle-power.

The Finance of Electric Lighting.

The contrast between the financial prospects and predictions of 1880-1 and the sober certainties of 1884 causes many of those who, in the earlier period, were full of confidence, to speak with mournful assurance of the "collapse of electric lighting." In truth, however, not only has there been no collapse, but there has been a steady and perceptible progress of invention and improvement. That which has collapsed are the avaricious fancies of those investors who allowed themselves to be misled by the glitter and unreality of representations that can only be characterized as fraudulent. So eager was the search for a good investment, and so robust was the faith in what was airily termed "electricity," that any one with a specification for lamp or dynamo found little difficulty in exchanging paper patents for hard cash. Now we have awoke out of sleep, it is the public who have acquired the experience and the promoter the money.

The concession of rights or franchises to supply cities and villages within a certain area, with current on demand and at fixed prices, was competed for helter-skelter by some of the shrewdest heads in the City of London. No one waited to inquire whether this thing, which was to revolutionize the conditions of life was or was not feasible and financially profitable. It was assumed that the problem was solved, and the public backed its assumption to the tune of eight millions sterling. The actual state reached by electric illumination was recorded in the history of a couple of exhibitions, in which each exhibit was jealously watched by an army of trained supervisors, and by the achievement of a little public and private lighting, accompanied for the most part at a heavy loss to the undertakers. Of further actual experience there was none. The daily press fostered the illusion, capital was got together, and so ended the first act of the comedy.

Expert witnesses, lawyers, promoters, accountants, directors and patent agents were fed on a lordly scale. The workman who could turn up a commutator, or could set brushes, was paid his own price; but the out-flow of money in those channels was found insufficient. "Free exhibitions" and installations at a loss furnished the vent which was needed, and those with rentals at the "price of gas"—whatever that may mean—contributed to the collapse of which we have spoken. But all is not yet lost. There are still three million pounds uncalled from the shareholders. If the real business of profit-earning is set about with open eyes and level heads, it is still possible *"tout peut se retablir."*

We have already dwelt on the legislative restrictions which obstruct the financial development of electric lighting. The letters from Mr. Arnold White and Dr. Fleming, which appeared in a recent issue of the *Electrician*, are unanswered, and, in our judgment, are unanswerable. But if the act were repealed, and a measure substituted for it wisely conceived in the interests of progress, while protecting the rights of property, we cannot shut our eyes to the fact that we should be little nearer the desired end if other reforms of a more administrative character were deferred or neglected. The extended scale on which the companies were laid down is better fitted for grappling with the business of a State Department than the languishing operations of a retail trade. Rent of offices and works, directors' fees and remuneration to staff for the most part were calculated on a turn-over of capital which has failed to appear. Unless, therefore, legislative assistance is supplemented by a vigorous use of the pruning knife and an improved administration, no fact in physics is more certain than that the capital yet uncalled will follow the millions which have gone before.

There are in the directorate of the various companies individuals who would not only adorn, but would guarantee the success of any undertaking with which they are connected. On the other hand, there are influences which—to speak with moderation—we can only regard with limited enthusiasm. Directors who are connected with a round dozen of companies cannot be expected to give that individual support, or make the resolute efforts without which no enterprise of so complicated and wide a scope as this can hope to succeed. The fact of a man undertaking the trusteeship of proprietors' interests in ten or a dozen companies at one time is a measure of the small importance he attaches to the performance of such duties. His efforts are diluted. "He spreads himself," as the Americans say, "too thin." When Stephenson was building the line to Birmingham, he walked fifty-three miles between London and the Midlands. Unless some such spirit as that of Stephenson animates those driving the coach, we may call until we are hoarse for a Board of Trade Hercules to pull our wheels out of the mud.

To sum up, electric lighting must be cheapened by a reduction in the permanent charges —*i., e.*, directors' fees, rent, and the cost of official staff. The administration must be seriously undertaken by men who rate the difficulty of their task too highly to suppose that odds and ends of time are sufficient in which to accomplish the end in view. Too great stress cannot be laid on the fact that management which would ruin a butter-man is not likely to organize victory for electric lighting. It is said that whatever money has been scraped together has been made up four pairs of stairs. Elevation of principle may not, perhaps, lead so high as this, but a new spirit of wise economy must permeate every department of electric lighting, or the champagne and glitter of the exhibitions will be the only things the country will remember of this effort to replace the existing method of artificial illumination. — *London Electrician.*

The Telegraphist's Electrical and Scientific Biography.

It is with much pleasure that we comply with the wishes of the large number of our correspondents who desire to learn something more about the father of electro-magnetic telegraphy. To the majority of telegraphists in this country the familiar word "Morse" has been nothing more than a mere name given to a certain kind of instrument; but in America the memory of this great man is almost worshiped, and a large volume has been published devoted exclusively to the life and labors of Professor Morse.

The following account from the "Encyclopædia Britannica" will be read with interest by British telegraphists, who ought to be reminded that up to the close of his long life Morse never failed to acknowledge the debt he owed our illustrious Faraday, whose brilliant discoveries in electro-magnetism were the stepping-stones to Morse's glorious invention.

Morse, Samuel Finley Breese, artist and inventor, was born at the foot of Breed's Hill, Charlestown, Mass., on 27th April, 1791. His father was the Rev. Jedediah Morse, D.D., the author of "Morse's Geography." At the age of fourteen Samuel Morse entered Yale College. Under the instruction of Profs. Day and Silliman he received the first impulse towards those electrical studies with which his name is mainly identified. In 1811, Morse, whose tastes during his early years led him more strongly towards art than towards science, became the pupil of Mr. Washington Allston, then the greatest of American artists, and accompanied his master to England, where he remained four years. His success at this period was considerable; but on his return to America, in 1815, he failed to obtain commissions for historical paintings, and after working on portraits for two years at Charlestown, S. C., he removed first to Washington, and afterwards to Albany, finally settling in New York. In 1825 he laid the foundations of the National Academy of Design, and was elected its first president, an office which he filled until 1845. The year 1827 marks the revival of Morse's interest in electricity. It was at that time that he learned from Prof. J. F. Dana, of Columbia College, the elementary facts of electro-magnetism. As yet, however, he was devoted to his art, and in 1829 he again went to Europe to study the old masters.

The year of his return (1832) may be said to close the period of his artistic and to open that of his scientific life. On board the packet ship Sully, which sailed from Havre Oct. 1, 1832, while discussing one day with his fellow-passengers the properties of the electro-magnet, he was led to remark: "If the presence of electricity can be made visible in any part of the circuit, I see no reason why intelligence may not be transmitted by electricity." It was not a novel proposition, but the process of formulating it started in his mind a train of new and momentous ideas. The current of electricity, he knew, would pass instantaneously any distance along a wire, and if it were interrupted a spark would appear. It now occurred to him that the spark might represent a part of speech, either a letter or a number, the absence of the spark another part, and the duration of its absence or of the spark itself a third, so that an alphabet might be easily formed and words indicated. In a few days he had completed rough drafts of the necessary apparatus, which he displayed to his fellow-passengers. During the twelve years that followed Morse was engaged in a painful struggle to perfect his invention, and secure for it a proper presentation to the public. The refusal of the Government to commission him to paint one of the great historical pictures in the rotunda of the Capitol seemed to destroy all his old artistic ambition. In poverty he pursued his new enterprise, making his own models, moulds, and castings, denying himself the common necessaries of life, and encountering embarrassments and delays of the most disheartening kind. It was not until 1836 that he completed any apparatus that would work his original idea, having been supplemented by his discovery, in 1835, of the "relay," by means of which the electric current might be reinforced or renewed where it became weak through distance from its source. Finally, on Sept. 2, 1837, the instrument was exhibited to a few friends at his room in the University Building New York, where a circuit of 1,700 feet of copper wire had been set up with such satisfactory results as to awaken the practical interest of the Messrs. Vail, iron and brass workers, in New Jersey, who thenceforth became associated with Morse in his undertakings. Morse's petition for a patent was dated September 28, 1837, and was soon followed by a petition to Congress for an appropriation to defray the expense of subjecting the telegraph to actual experiment over a length sufficient to establish its feasibility and demonstrate its value. The Committee on Commerce, to whom the petition was referred, reported favorably. Congress, however, adjourned without making the appropriation, and, meanwhile, Morse sailed for Europe to take out patents there. The trip was not a success. In England his application was refused on the alleged ground that his invention had been already published; and while he obtained a patent in France it was subsequently appropriated by the French Government without compensation to himself. His negotiations also with Russia proved futile, and after a year's absence he returned to New York. On Feb. 23, 1843, Congress passed the long-delayed appropriation. Steps were at once taken to construct a telegraph from Baltimore to Washington, and on May 24, 1844, it was used for the first time. Morse's patents were already secured to him and his Associates, and companies were soon formed for the erection of telegraph lines all over the United States. In the year 1847 Morse was compelled to defend his invention in the courts, and successfully vindicated his claim to be called the original inventor of the electro-magnetic recording telegraph. Thenceforward Morse's life was spent in witnessing the growth of his enterprise, and in gathering the honors which an appreciative public bestowed upon him. As years went by, he received from the various foreign Governments their highest distinctions; while in 1858 the representatives of Austria, Belgium, France, the Netherlands, Piedmont, Russia, the Holy See, Sweden, Tuscany, and Turkey appropriated the sum of 400,000f. in recognition of the use of his instruments in those countries. In the preparations for laying the first Atlantic cable he took an active part, though the attempt of 1857, in which he personally engaged was not successful. He died April 2, 1872, at New York, where his statue in bronze now stands in the Central Park. His instrument and alphabet are now used on 95 per cent. of the telegraph wires of the world. —*The Telegraphist.*

Telephonic News

*** A Detroit telephone got out of order, and the man who was sent to fix it up discovered that a hole had been punched in the instrument by somebody who had innocently thought he could hear better through it that way.

*** The American Bell Telephone Company's net output of telephones since the beginning of the present fiscal year, compared with the same time in 1883, is shown by months, (ending the 20th) in the following table :

	1884.	1883
March	3,252	4,739
April	4,483	7,342
May	5,023	6,758
June	4,568	7,038
July	2,278	5,846
Total	19,604	31,723

*** In a description of the new Ducousso Telephone, our contemporary *La Lumière Electrique* says :

In the telephone apparatus usually employed, the induced currents that transmit and reproduce speech traverse the induction and receiving bobbins in the two stations; and yet it would suffice were the fine wire of the induction bobbin in the line circuit during transmission, and were only the receivers in the circuit at the moment of receiving. Use is no longer made of those hand-actuated interrupters that permitted the generator or the receivers to be placed in the circuit according as transmitting or receiving was being done. It is probable that, by reason of the high tension of telephonic currents, the bobbin resistance in the circuit does not perceptibly lessen their intensity; but these bobbins are provided with magnetic cores that necessarily react upon them, and this effect may interfere with the distinctness with which the hearing may be done.

Mr. Ducousso's telephone is arranged in such a way as to utilize the fine wire bobbin for transmitting as well as for receiving. It consists of a soft iron core, one of the poles of which faces an ordinary soft iron diaphragm. This core is surrounded by a fine wire bobbin that corresponds to the line circuit. Alongside, upon the same core, there is a coarse wire bobbin that corresponds to the pile and microphone circuit. The variations in the intensity of the primary current in the last-named circuit give rise to induced currents in the bobbin by reason of its proximity, and also through the intermedium of the soft iron core, which is the seat of a variable magnetic state depending upon the primary current. At the receiving station, the microphone being mute, the core is constantly magnetized, but the induced or other currents that pass into the bobbin modify such magnetism according to their form, and the diaphragm is similarly actuated.

In ordinary stations, where two receivers are usually employed, the inducting bobbins of the two telephones are arranged for tension, and the same is the case with the induced ones. And yet, in particular cases, it may be preferable to arrange the inducting bobbins for quantity and the induced ones for tension, or we may have two piles and one microphone acting upon the same receivers.

The absence of a permanent steel magnet renders the construction of this apparatus simpler and more convenient to use. It is very light, and its shape is very graceful.

The inventor claims the following advantages for his apparatus: (1), suppression of the permanent steel magnet; (2), an arrangement that permits of a complete utilization of the internal resistances, in transmitting as well as in receiving; and (3), the facility of grouping the inducting and induced bobbins for tension or for quantity.

Multiplex Telegraphy.

The London *Electrical Review* says that the constant demand which is made from time to time for a decrease in the price of telegrams, shows that any devices which may enable a large amount of telegraph work to be transmitted at a small cost would be likely to prove remunerative to an inventor. The latter, however, before proceeding to design such apparatus should first clearly understand the conditions under which economy would result from the adoption of the same. At the present time several forms of multiplex and also of fast-speed instruments are in existence, and, under certain conditions, they do their work well. The Baudot, for example, is used on the continent with success ; but no one who has seen its construction can say that the latter is simple, or that the very general adoption of the instrument would conduce to economy. The item of maintenance is one which most inventors who work simply as mechanicians, almost entirely, if not entirely, leave out of calculation ; yet any complication in telegraphic mechanism which renders it unusually liable to derangement adds considerably to its annual expense, and this may more than counterbalance any advantages which may be inherent in the principle on which the apparatus is constructed. Simple as is the simplest form of multiplex apparatus—viz., the duplex—it, on its first introduction, proved a failure from the defective state in which the telegraph lines were at the period. At the present day, on account of the excellent condition into which experience has enabled the aerial lines in this country to be brought, the duplex system works without difficulty ; and even the more recent developments, the quadruplex, is largely employed. But the latter, in spite of the perfection to which it has been brought in Great Britain (having been entirely remodeled from the original American instruments), cannot be made to work satisfactorily over lines of an extreme length, owing to the variations which continually take place from the extreme humidity of this climate. Were the Baudot instrument tried, its failure here would be certain. A successful multiplex instrument, therefore, would have to be designed on principles somewhat different to those upon which the Baudot is constructed. Should the use of underground lines become general, the employment of multiplex instruments would probably come within the range of practicable telegraphy, as the element of variation would practically cease to exist, though the element of inductive retardation would have to be overcome. Although we believe that eventually this will be the case, yet at the present time not the slightest real progress has been made towards counteracting its effects by any method of transmitting signals.

The Mackey-Bennett Cable.

The completion of the Commercial or Mackay-Bennett cable between Waterville, Ire., and Dover Bay, N. S., has been announced.

The ordinary system of receiving messages sent through ocean cables by means of a mirror is not to be used by the Commercial Cable Company. By the old method a small mirror is substituted for the needle of a galvanometer, so that it swings to and fro as the current changes, the positive current forcing it one way and the negative the opposite. The mirror is controlled on the other side of the ocean by a keyboard of two keys, one of which when pressed produces the positive current, and the other the negative. The alphabet consists of a combination of the effects produced by these two vibrations. The mirror is about the size of a ten-cent piece, and has before it a lantern with a slit in it about as large as a lucifer match. Through the slit a light is thrown upon the mirror, which in turn reflects it back upon a surface traced with the lines of a scale. As the ray of light travels backward and forward upon this scale, the message is read by the receiver. There are obvious objections to this method. In the first place it requires two men, one to keep his eye constantly fixed upon the scale, and the other to write at his dictation. The Commercial Cable Company proposes to employ a system which requires the services of only one receiver, and to adopt what is known as Thomson's recorder. This is an automatic arrangement of delicate and intricate construction, but said not to be liable to get out of order. It is operated by means of a lettered key-board, and traces characters upon a running slip of paper. It is said that the mirror system has been used because it can work on such a very feeble current ; but it is expected that better results will be attained by the new cable than in former enterprises of this kind.

Life in the Telegraph Service.

Life in the telegraph service is about the same as in other branches of business, if viewed from the standpoint of individual idiosyncrasies; and yet, take it all round, there are, of course, certain clearly-defined lines which mark it off from life in any other trade or profession.

We have often been amused and much puzzled at the general appearance of a telegraphist. Now, in saying this much, you must not misjudge our statement, but permit us to explain what we mean. We are speaking now of men who have been eight, ten or twelve years in the service, and we will hazard the opinion that in such men there is a distinct peculiarity that to a close observer is at once noticeable. Should the latter meet a telegraphist in the streets, we venture to assert he could at once pick him out. This peculiarity is scarcely expressible in words, and yet it is *in him*, as sure as the complementary colors are in the white beam of light. Can it be his work which lays its impress upon him in such a manner? Just possible it may be; for, if you recollect what his labor is, you will readily find he is really neither clerk nor mechanic, in the truest sense of the word. This hour he is busily employed transcribing a message delivered to him in Morse language by his dear "pony-sounder," or writing it from slip that has passed through a "Wheatstone automatic," while the next hour he is hard at work pegging away with his key in the sincere, though vain, attempt to beat time as it flies by keeping down delay.

The variety of his work, you will see, is so great, and the difference so marked, that the man is certain to manifest somewhat of this incongruity in his general habits. Any one who has mingled much with the junior telegraphists—say, of three years' service—must have been often questioned by them as to the reason why "*our* fellows don't look like *other clerks*," etc.

Take the service, however, all round, and we do not think you will find a happier, more genial, or more social acquaintance than the modern telegraphist. Life in the service has its light and shade, its joys and its discomforts, although the wisest course is to always try to look upon the sunny side; and, in estimating the worth of one's situation, we must not forget to compare it with that of those who are lower in the social scale.

Mr. Editor, you have no idea, sir, of the many little pleasantries we telegraphists enjoy amongst ourselves. The amusing telegrams that pass through our hands give us many a laugh, while the errors made by our fellow workers of less experience than ourselves create no little amusement. It is really a case of acting upon the apostolic injunction that the strong should help the weak. Many an amusing and possibly serious error would pass out to the public were we not to act upon this principle. What would the feelings of the husband have been had he read such a telegram as the following from his mother-in-law: "Annie was confined of a *deal box* this morning." Then, too, we have just as peculiar messages from the public. Imagine the sensation in the receiving telegraphist's mind as he hears the armature of his sounder signaling the following: "Unto us a child is born nine feet long and four feet broad." Yet it was quite correct; probably an order for a "motto" for a church altar, and giving the length required. You, of course, have heard of that amusing error in a message on the morning of the late Pope's burial in St. Peter's, in Rome, wherein his Holiness was stated to have been buried in saltpetre!

The language and terms used in telegraphy become the second nature of a telegraphist, so that you will not be surprised to hear of a "masher" in the service receiving an anonymous note as he sat at his circuit, with a collar two inches high round his neck, asking him to "reduce ten." A sharp and ready-witted answer was once given to a member of the staff, who has "the gift of the gab," by one who had been vainly trying to get a word in sideways. When the fluent one did stop, the latter immediately said, "N. U. G.," which, of course, you know, signifies "Not up, go on."

There is one side of life in our service which is frequently overlooked, and that is the palpable fact that a telegraphist is not an automaton. To-day he is probably at 212° and is rattling his ten, eleven or twelve messages off in a quarter of an hour, while to-morrow he is at 32° or zero, and, do what he may, he cannot exceed eight in the same time. However this may be accounted for or regretted, the fact remains and will always do so. By the way, I may mention a Wheatstone transmitter is not always constant, and, by reason of faults or temperature or climatic changes, frequently differs in speed.

The work of telegraphy is really pleasant and attractive. What can surpass the feeling of power and command that passes over one as he handles his single or double-current key, and realizes the mighty power he possesses of directing and controlling that marvellous and mysterious force, the electric current?

With a touch of the key that unknown force obeys him more readily than the vessel its rudder, or a charger its reins. Its docility is wonderful! How attached we become to the little "sounder," or to the "single needle." We develop quite an affection for them. The service, however, is still in its infancy. There has not been time to tabulate results as to the effects work of such a distinctively nineteenth-century character has upon the human frame. The telegraphist is in the fore front of the busy, rushing, restless activity of commercial life of to-day. All his nerves are constantly on the stretch while he is at work, and terrible must be the strain on his nervous mechanism. How it will end the future only can tell. At present it makes him very subject to irritability and hasty temper.

He needs to guard closely against such a temptation. No wonder, therefore, that he soon loses his temper in working the wires, and quarrels break out between clerks at distant stations. How instinctively they know the very best means to annoy one another if so disposed. Such strange phrases as "Read," "Get a postman to help you," "Get clerk," etc., from sending clerk to receiver at the other end ; or, "Send better," "Try your other foot," etc., from receiver to sender, are frequently to be heard on the instruments. Of course, such remarks are prohibited, and severely dealt with if brought before headquarters. Still, they do occur. Much gentleness and patience are needed to prevent quarrels and obstructive working. If we could always remember that it takes two to make a quarrel, and that quiet, steady working wins everywhere, there would be fewer sheets of foolscap used. We ought not to deride irregularity forms, because they are the means by which the staff becomes acquainted with the numerous and generally well-arranged rules of the department. Many a "sheet of blue" requesting a gentleman to "note a caution," or asking his explanation as to "so and so," has been the round of the ladder by which he eventually attained that enviable position of exemption from "reports," gained by careful and intelligent working of the lines laid down by his superiors.

Still, working telegraphy is a terrible strain on the system, especially at the duplex (key or automatic). Failing currents, earth contacts, unsteady balance, with probably an

erratic worker at the other end of the wire, combine to worry and harass the poor fellows almost out of their minds, while Wheatstone, working with its high speed, sending the messages off before they can be timed and arranged in order, and "the acknowledgments" seen to, creates quite a continuous attention.

How nobly and energetically the work is cleared off after stoppages can only be appreciated and understood by those who have seen it performed.

The department believe in strict punctuality, and we think we are safe in asserting there is no other profession where keener attention is paid to this. To their credit, however, be it said, they are just as impartial in permitting the staff to leave promptly at the hour their duties are up. Of course, it is a case of "wheels within wheels." If the "coming-on" staff is prompt to time, it follows that the men they have come to relieve are bound to be smart in getting off. Of course, Mr. Editor, there are a few laggards or drones *who cannot be punctual*. They try, and try hard, to get "on duty" as the clock strikes; but it is of no use—they are certain to drop in just a few minutes late, with the inevitable result of getting "noted." This habit of punctuality, so firmly and surely ingrained into him by the department from his youth, makes the telegraphist a reliable man in any business or social appointment, while, at the same time, it makes him a terrible foe to all waste of time, or slothful companions and acquaintances. His business habits and domestic affairs are all methodical. He is trained to have a method in his manner of working, and hence exhibits this trait in social life.

The one great drawback to our pleasure is the Sunday labor we are obliged to take a turn of. Happy he who can get a substitute for his duty on the day of rest. He returns to his work on the Monday with greater zest and a happier and more cheerful air. The day's break in the monotony of daily toil seems to have braced the entire man, while the instruments appear to be more attractive and look better.

Of course, life in the telegraph service depends upon the color of the glasses the telegraphist uses in looking at it. But, on the whole, we think one and all will unite in praising it for its happy, varied experience; its amusing and instructive information, and its sure and steady development of excellent and abiding traits of character in the lives and habits of its devotees.—*The Telegraphist.*

Dictionary of Technical Terms.

Accumulator—Another name for secondary batteries.

Ampere—The B. A. (British Association) unity of current.

Amplitude—The extent of swing, as in a pendulum, or the height of wave-motion; the strength of wave-action, as the loudness of sound, depends on this, while the character, as pitch of note, depends on wave-length or time.

Anion—The electro-negative acid or chlorous radical of the salt or acid decomposed. Oxygen acid radicals as chlorine are anions.

Anode—The positive electrode or pole of a battery, the wire or plate connected to the copper or other negative element of the battery; the plate which leads the + current into a solution to be decomposed, and at which are set free the oxygen, acid radicals, and all—ions (anions). In electro metallurgy it is usually formed of the metal to be deposited, in which case it is called the soluble anode or pole.

Arc—The air space in which the electric light forms. It contains carbon vapor, and gives off the violent rays which render the arc light so steely in character.

Armature — The keeper of a magnet. Armature of dynamo machine—the part which, like the keeper, closes the magnetic lines of the field magnet. It is usually the moving part.

Astatic—Without inherent directive power usually applied to pairs or reversed needles.

Atom—The supposed ultimate particle of the elements. There is still much confusion as to the atom and equivalent, which were formerly used for the same purpose, but modern chemistry attaches a distinct idea to the atom, which correlates it, not only to chemical affinity, but to heat and other forces.

Ballistic Galvanometer—This measures a momentary current, such as a discharge of a condenser, just as a ballistic target measures the impact of a shot. It requires a heavy needle presenting little surface to the air. The quantity of electricity is proportional to the sine of half the angle of the first swing.

Brushes of Dynamo Machines—The collectors of the current.

Calorimeter—Instruments for measuring heat produced, for electrical uses. They are, in fact, thermometers; but for measuring the heat produced in chemical actions, etc., very elaborate instruments are made, as described in treatises on heat.

Candle, Electric—An arc light generated at the end of two carbon rods arranged side by side, and burning away equally. First made by Jablochkoff.

Candle-power of Light—The legal standard for measurement of gas is a spermaceti candle of six to the pound, burning at the rate of two grains per minute.

Capacity—The power of a surface or dielectric arranged as a condenser to hold electricity as "static charge." Its unit is the farad.

Cascade, Charging in—The old term for Leyden jars arranged in series like voltaic batteries.

Cathode—The negative pole of a battery; the wire or plate connected to the zinc; the plate at which, in any decomposition shell, cations or + ions are set free. In electro-metallurgy, the object upon which the deposit is to be formed is the cathode.

Cation—Electro-positive elements and radicals which are set free in electrolysis at the cathode. Hydrogen and metals in the order of the electric series are cations.

C.G.S. Centimeter Gramme Second Charge—The measured quantity of static electricity accumulated on a conductor or a condenser.

Chlorous Pole—A term sometimes used for the negative pole or cathode. A chlorous radical is that radical of a salt or acid which answers to chlorine in HCl—that is, it is the acid radical or electro-negative element or anion.

Consequent Poles—Where intentionally or accidentally, two N. or two S. poles are formed together S—N N—S, in which case we have, apparently, a magnet with two similar poles at its ends.

Constant—A value which correlates individual cases to general laws. The constant of a galvanometer is the value in amperes corresponding to unit deflection; or it may be the resistance which, with a given battery, produces unit deflection.

Coulomb—The B. A. unit of quantity which passes in one second of an ampere current.

Declination—The angular difference at any part of the earth, between the nearest pole of the earth and the corresponding magnetic pole: it is the variation of the compass.

Density—"The quantity" upon unit area of surface, which varies on the one surface according to form and nearness of surroundings.

Density of Current—The same as with charge, in the case of electrolysis which materially affects the action and the quality of deposit. Heat in wires is also proportionate to the ratio of current and section of the conductor.

Diaphragm—A porous division between two liquids, through which electric current passes, and in which osmose occurs; and an E.M.F. is produced as a result of capillary actions.

Dielectrics—Non-conductors in which induction occurs, such as air and gutta-percha.

Dynamometer—This means "force measure," and is the proper name for an apparatus which measures mechanical power, such as that exerted by a rotating shaft or a belt. It is often, but wrongly, applied to Weber's galvanometer, which consisted of coils in place of needles suspended within other circular coils.—*From Sprague's Electricity.*

Steno Telegraphy.

M. Cassagnes, C. E., has written an ingenious little pamphlet bearing this title, in which is a description of his proposed method of telegraphing shorthand, his idea being that reporters' shorthand notes of speeches, &c., can be telegraphed straight to the papers and transcribed in their offices, thus saving them much time and money.

.... At the annual meeting of the stockholders of the Vermont and Boston Telegraph Company, held at White River Junction, Vt., on Wednesday last, the following gentlemen were elected directors: Norvin Green, T. T. Eckert, C. C. Tinker, and Roswell H. Rochester, of New York; Thomas Roche and Henry C. Sherman, of Boston; Norman Williams, of Chicago; George W. Gates and George W. Smith, of White River Junction.

.... Referring to the action brought in the Supreme Court recently by Henry C. Gardiner against the officers and directors of the Commercial Telegram Company, to compel them to account for the $1,000,000 representing the stock and the difference between the par value of the stock and the sales made at $30 and $50 a share. Mr. S. W. Fullerton, a director and the former president of the company, made a statement last Thursday. "The Commercial Telegram Company," he said, "was organized by Luther E. Shinn, George W. Casper and myself for the purpose of constructing and maintaining telegraph lines and the operation of telegraph printing instruments for reporting market quotations and commercial news. The company was created on the basis of a capital stock of $50,000, divided into 500 shares of $100 each. The certificate of incorporation provided that the capital stock might be increased, and it was subsequently increased to $1,000,000. This was done not only in accordance with the law, but in accordance with a custom usual in such cases." The company, Mr. Fullerton said, "met with strong opposition from the old Gold and Stock Telegraph Company," but it had thus far overcome all opposition and had been surprisingly successful. Several hundreds of the instruments invented by Stephen D. Field had been invented for the company, and are now in active use. No one but Mr. Gardiner had ever disputed these patents and inventions. Many statements in Mr. Gardiner's complaints were characterized as gross falsehoods by Mr. Fullerton. "If Mr. Gardiner's statement that he paid $6,000 to Gov. Richard C. McCormick for his 100 shares of stock is true," said Mr. Fullerton, "it speaks well for Mr. McCormick's estimate of the standing and prosperity of the telegram company. It is not true, as asserted by him, that 300 shares of the original stock of the company were voted by the incorporators to Mr. Shinn, or that the remaining 200 shares were voted to Mr. Casper and myself. It is not true, as he states, that the Board of Directors directed that the increased capital stock of $1,000,000 be issued to themselves, nor was it so issued. It is not true, as stated by him, that Mr Shinn divided the proceeds of a check for $1,000,000 with Mr. Field, Mr. Casper and myself, or with any of us. It is not true that the directors of the company have dissipated its capital, nor is it true that the incorporators conspired against the interests of persons who might become purchasers of the stock. Mr. Fullerton admitted that Mr. Shinn gave 3,750 shares of his stock to the company, of which 2,000 shares were made preferred stock, but he said that this transaction took place long before Mr. Gardiner became a stockholder. Mr. McCormick, who then held and owned the identical stock afterward sold by him to Mr. Gardner, signed a written consent with all the other stockholders of the company that these 2,000 shares might be made preferred stock, and be entitled to preferred annual dividends of 3 per cent.

TELEGRAPHIC

.... The telegraphic connection between America and the Old World is happily characterized by a head-line in the New York *Herald*, "The International Hyphen."

.... The Baltimore & Ohio Telegraph Company has reduced its tolls from New York, Philadelphia, Baltimore and Washington to Chicago, Cincinnati, Cleveland and Columbus, O., to twenty-five cents for ten words.

.... Mr. W. A. Schutt, Superintendent of the Manhattan District Telegraph Company, has resigned that position. W.E Huntington, Superintendent District Telegraph Department for the B. & O. Company, will also fill the position made vacant by this resignation.

.... Correspondence is almost suspended in Marseilles, except by telegraph, for fear of the danger of cholera through the mails. That city and Toulon have become almost depopulated by the flying inhabitants, as the deaths now amount to over fifty per day in Marseilles.

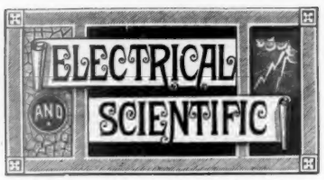
.... In order to avoid delay in acting upon the contents of telegrams in case of the absence of the addressed, the German telegraph authorities have adopted the symbol R. O., which is transmitted before the address, and signifies that the message may be delivered unsealed. The sender may authorize these instructions by payment for one extra word.

.... At the annual meeting of stockholders of the Atlantic and Ohio Telegraph Company, now controlled by the Western Union, held last Wednesday, at Tenth and Chestnut Streets, the following directors were elected: Norvin Green, General Thomas T. Eckert, James Merrihew, R. H. Rochester, John B. Van Every, W. B. Gill, S. S. Garwood, Henry Bentley and Chas. A. Tinker. The Board held a meeting by means of telegraphic communication, and elected Norvin Green president; General Eckert, vice-president; and R. H. Rochester, secretary and treasurer.

.... The shortest telegraph line owned and operated in America by a stock company, incorporated for that sole and especial purpose, is probably the Eastern Union Telegraph Company. The line extends from Greenport, L. I., ten miles to Orient. Greenport is an old whaling station and the terminus of the main line of the Long Island Railroad. It is on the northern of the two peninsulas into which Long Island divides itself on the east, while Orient is ten miles to the eastward, and on the extreme point of the peninsula. Orient is a hamlet of 500 inhabitants in winter, and of 1,500 in summer, about 1,000 of them city visitors. A little steamer plies between Orient and the Connecticut shore, which is about ten miles distant. The inhabitants of Orient live by fishing, by the coasting trade, which consists mostly of coal carrying, and by market gardening, most of the produce going to Boston.

When the public spirited residents of Orient first broached the proposition to build a telegraph line to Greenport, to connect with the Western Union, which terminates at that point, the Western Union Company got wind of it and offered to build the line if the people of Orient would furnish the telegraph poles. The Orientals thought the matter over and got out their pencils and paper and ciphered that the poles grew so far away that they would be too expensive, so they said, "No, thank you," to the Western Union Telegraph Company. That was two years ago.

A stock company was formed, with J. Brown Young, of Orient, for president and Wilbur F. Hammond, of Greenport, superintendent. The capital stock was $1,000. It is owned in Orient, Greenport, and New York City. Superintendent Hammond built the line for $450, including instruments and all appurtenances. There are three stations on the line. Greenport, East Marion, and Orient. An annual dividend of 35 per cent. has been paid to stockholders since the line was built.



* * Telegraphic communication between London and Berlin was recently interrupted, owing to the highly charged state of the atmosphere.

* * The following gentlemen have been nominated for the Legion of Honor: Dr. D'Arsonval, of the College of France, a well-known electrician; and M. Postel-Vinay, an electrical engineer.

* * The longest single line of pneumatic tubes in successful operation runs between the London (England) Central Telegraph office and the House of Commons, a distance of two and three-fifths miles.

* * A new use for electricity, says the Pittsburgh *Dispatch*, is claimed by a scientific genius, who states that he can take a man who is on the point of being paralyzed by alcoholic potations, and by the application of electricity, so neutralize the alcohol as to restore him to his senses in five minutes.

* * The largest gold nugget ever found in Eastern America was recently exhibited in Philadelphia. It weighed about four pounds and contained nearly $1,000 worth of gold. It was found in Montgomery county, N. C., forty miles east of Charlotte, and two miles from Yadkin river, in a gully, where it had been washed out from the decomposing rock.

* * A French paper says that the railway companies are about to try an electric gate opener. The method to be tried is briefly as follows: A catch connected with an electro-magnet keeps the gates closed. An approaching train closes the circuit at a certain distance from the gates, the catch is released, and the gates open. When the last carriage has passed, the circuit is broken again and the gates close. A bell is also rung as the train approaches.

* * For an etching fluid for steel, mix one ounce of sulphate of copper, half an ounce of alum, and half a teaspoonful of salt reduced to powder, with one gill of vinegar and twenty drops of nitric acid. This liquid may be used for either eating deeply into the metal, or for imparting a beautiful, frosted appearance to the surface, according to the time it is allowed to act. Cover the parts it is necessary to protect from its influence with beeswax, tallow or some similar substance.

* * What is claimed to be a valuable rust protector is among the recent German inventions. It consists of ordinary oil paint mixed with ten per cent. of burned magnesia, baryta or strontia, as well as mineral oil. This neutralizes the free acid of the paint, and the alkaline reaction protects the iron from rust. As a preventive of iron rusting in the ground, the metal is painted over with a mixture of a hundred parts of resin, twenty-five parts of gutta percha, fifty parts paraffine and twenty parts magnesia, besides mineral oil. A temporary paint for the movable portions of machinery contains some twenty or thirty per cent. of magnesia or burnt dolonite, with some vaseline added to prevent drying.

* * Ever since the beginning of the year the electric light has been considered a great desideratum as a headlight for locomotives. During the past two weeks it has been subjected to a practical test on a New York, Pennsylvania and Ohio engine between Galion and Dayton. Mr. Charles Latimer, Chief Engineer, and other officials of the road have witnessed the working of this light, and they express themselves as highly pleased and thoroughly satisfied. The power of the electric headlight is 8,000 candles, about one hundredfold that of the oil light now in use. Thirty-three telegraph poles, a distance of about a mile, can be seen ahead of the engine as plainly as one-tenth that distance by the common headlight. Without going into details, it may be said that the whole mechanical apparatus for the electrical appliance weighs about 400 pounds, and consists of a dummy engine and a dynamo machine, together with the reflector.

* * There is nothing yet invented that can be said to be absolutely fireproof which affords protection to window spaces or doorways, but the heavy wooden door or shutter encased in tin has undoubted advantages. If two thicknesses of inch board—pine being preferable, because it does not warp—are nailed crosswise and fully encased in tin, locked and soldered, and thoroughly nailed under the locking, the outer surface of the wood under the tin will be speedily reduced to charcoal by the action of the heat, through the combustion of the small amount of oxygen under the tin. The charcoal itself then becomes a very effective non-conductor of heat, and, if the tin is tight, so that no further supply of oxygen reaches the unburnt wood beneath the charcoal, it will remain cool and strong for some hours, thus giving time to control the fire where it starts. Iron doors and shutters, on the contrary, when exposed to severe heat, become so quickly warped and twisted as to be practically useless as safeguards.

* * Cleveland expects soon to be able to boast of the only street railway operated by electricity in the United States. Successful experiments have been conducted for six months past at the works of the Brush Electric Light Company by Mr. Walter H. Knight, one of the inventors of the system, and the results have warranted Mr. Knight to put his invention to practical use by running an electric road from the Garden street car-barns to New street, and up New street to Quincy street as far as Lincoln avenue, altogether a distance of over 1½ miles. Should the experiment prove successful the system will be adopted on all the branches of the East Cleveland street railroad. The system to be employed is known as the Bentley & Knight system. A narrow channel is being dug between the tracks to protect the iron conductors of electricity, placed within the box supported on wooden pins, used as insulators. A Brush dynamo machine will be built in the street-car barns, which will be connected with the conductor. A motor will be placed on each street car, regulated with a lever, and the current to the motor on the street car will be drawn up by means of copper brushes adjusted to the bottom of the car and connected with the motor.—*Railway Review.*

* * The industrial exhibitions this year promise well. We are to have everything from a World's Fair to a country agricultural show. There are to be eight or ten industrial exhibitions of note, the greatest of which will be the World's Industrial and Cotton Centennial Exhibition at New Orleans, beginning the first Monday in December and running until the 31st of May, 1885. Then there is to be an International Electric Exhibition, under the auspices of the Franklin Institute, in Philadelphia, from September 2d to October 11th. The Southern Exposition, at Louisville, Ky,. opens August 16th and closes October 25th. The Cincinnati Industrial Exhibition opens September 3d, and closes October 4th. The Massachusetts Charitable Mechanic Association will open their exhibition in Boston some time in September, and let it continue ten weeks. The New England Manufacturers and Mechanics' Institute will hold an exhibition in Boston from September 3d to November 1st. The Mechanics' Institute of San Francisco, will hold its annual exposition from August 5th to September 6th. The St. Louis Exposition opens September 3d, and closes October 18th. The Colorado Industrial Exhibition, at Denver, opens about September 1st.

Some time in 1885, the definite time has not yet been decided on, there will be an exhibition of American products in London. General C. B. Norton, well-known in connection with our late foreign exhibition, will have charge of the arrangements, and this insures success as far as the management is concerned. It is to be hoped that the exhibit will contain a large variety of our products, as much good will come of it.

* * The practical difficulties in the application of the new standard of light fixed upon by the Paris Congress are likely to prevent its extended use. Dr. Werner Siemens suggests the following modification of this standard, viz.: that instead of measuring with the aid of a surface of liquid platinum on the point of solidification, we should measure with solid platinum on the point of liquification. If the solidifying and melting point of platinum are identical, his method would give absolutely the same results as that of the Paris Congress. If, however, further researches should prove that platinum melts at another temperature than that at which it solidifies, then a correction will have to be made by introducing a coefficient, expressing the proportion between the light emitted by platinum at these two temperatures. The apparatus of Dr. Werner Siemens consists of a closed metallic box, within which a thin strip of platinum foil 6 mm. wide and 0.02 mm. thick can be heated by a current from some cells. A circular opening in one of the sides of the box of exactly 0.1 square centimeter area allows the rays of light from the incandescent platinum (which is immediately behind the opening) to pass out to the photometer. In taking a measurement the current is gradually increased, and the screen of the photometer gradually shifted so as to maintain always a photometric balance between the platinum and the source of light which is to be measured. The position of the screen at the moment when the platinum lamp is extinguished—that is, at the moment when the foil has melted—gives the value of the light measured in new standard units. The platinum foil is coiled upon a small drum, and by means of a set of levers moved by a handle from the outside of the box, a new surface of the foil can immediately be brought before the opening in readiness for another measurement.

Summer's Electric Storms.

The freaks of the electric storms recently almost resemble those of a playful giant intent to show his force and do little deadly mischief. It is noticeable that the storms this summer come in series, slipping over some districts of the country like beads upon a string, with a clear interval for the string. From New London, Conn., comes the report that they have had sometimes two or three storms in succession, but always one for every day this month, up to Monday. In Berks county, of this State, there have been magnificent displays of alternate moonlight and lightning; as many as five thunder storms in one night, with clear skies intervening. The same bolts in Connecticut that split up a forest of young elms and oaks, also tore up into splinters the crib in which a baby was lying, but simply rolled the infant out upon the floor unhurt. On one New York railroad the lightning struck a tool-box, exploding a number of dynamite cartridges, and on another the playful force hurled a kerosene lamp from its stand and deposited it in a coalscuttle, without breaking the glass or setting fire to the oil. Copper wire, used in hanging pictures, has been melted at the point where it touched an iron nail and mirrors have been shivered because of their metallic backs; furniture torn apart, probably at its nailed or screwed corners, but no inmate of the house where some of these curious exhibitions were made suffered any serious damage besides a tingling or numbness in the feet from the shock. Glass windows that were closed stood untouched, while iron clothes-hooks were melted apart and broken, and after one elephantine bolt a cork was found nearly drawn out of a closed alcohol bottle, whether from the concussion of the air or expansion of its contents does not appear. The lesson of all these relations seems to be for human beings: "Don't make yourselves conductors of electricity by getting into line between a bit of metal and the ground." It is some years since a Philadelphian was killed up in a White Mountain thunder-storm, by occasionally resting his head against the metal bell-pull in the door-post, against which he was leaning. When in an "electric storm" one is taken and another left, the person killed has undoubtedly been either in physical condition or local position to make a "connection" for the electric force. With the close study of electricity working for man, we shall doubtless arrive at the necessary equipment to protect him from being, in the old phrase, "struck by lightning." Closed glass windows are better security than open sashes and draughts. In walking through an electric storm it is better to be drenched and wet, in the open country, than to hold up an umbrella or take shelter under a tree.

The following circular has been addressed to a large number of scientific men. It was enclosed in a printed book entitled "Tests, Measurements and reports of the International Electrical Exhibition," Philadelphia

Sir:—The Franklin Institute of Pennsylvania for the Promotion of the Mechanic Arts, in pursuance of the object for which it was incorporated in 1824, and in accordance with the history of the organization, has inaugurated another of its periodical exhibitions. This display will be limited to electrical appliances and articles properly associated therewith, and will be the first electro-technical exhibition held in America.

The applications for space, and the general interest manifested throughout North America and Europe, lead the Managers of the Institute to anticipate an exhibition of such magnitude and importance as to form not only an era in the history of the Institute, but also in the progress of electrical science.

Preparation for this work has entailed upon the Committee on Exhibition personal sacrifices that can only be appreciated by those who are familiar with similar enterprises. It is unnecessary to say that these efforts are voluntary, and have been prompted by a desire to serve the interests of science. It is, therefore, entirely proper that the Franklin Institute should, in the same spirit, invite men of scientific attainments to join with them in gathering the fruits of this labor.

To better accomplish this purpose, invitations will be extended to a large number of able, scientific men, to serve as members of a Board of Examiners. To secure careful and exhaustive work, a code for the conduct of measurements, tests and reports has been prepared in accordance with rule 12, republished in the General Code.

GENERAL CODE FOR THE CONDUCT OF MEASUREMENTS, TESTS AND REPORTS

to be made at the International Electrical Exhibition of 1884, of the Franklin Institute of the State of Pennsylvania:

First.—The following code shall be considered binding upon the examiners and exhibitors concerned.

Second.—Examiners, who may be commercially interested in any class of articles, shall not serve as examiners in that class; and also shall not serve if, prior to the investigations, proper objection be made by any exhibitor concerned.

Third.—If time permit, tests undertaken will not be abridged, nor will withdrawals from tests be allowed.

Fourth.—Quantitative tests shall, as far as possible, be made by methods which allow of a proper checking of results, and all codes or schemes for tests shall be approved by the Board of Examiners.

Fifth.—All parties making application for tests thereby bind themselves to acquiesce, without appeal, in the results of the tests.

Sixth.—Reports of the results of tests and examinations made by the several sections of the Board of Examiners shall, as far as practicable, include details of methods used and experiments made, and the reports of the same shall be signed by the majority of the members of the section.

Seventh.—All rough notes and original records shall be carefully preserved, and no erasures made.

Eighth.—Complete records of the work done by the examiners shall be rendered to the Board of Managers of the Franklin Institute, and all publications of results shall be made by authority of said Board.

Ninth.—The reports of the Board of Examiners shall take the place of the usual awards and premiums. These reports, therefore, shall be based either upon quantitative or quali-

tative tests, and no report shall be made by examiners on exhibits not so examined.

Tenth.—Exhibitors and those applying for tests shall communicate to the Board of Examiners such descriptions and drawings as may facilitate the labors of the Board, together with statements of claims as to meritorious points of exhibits. They shall also make such necessary attachments and connections as may facilitate the labors of the Board, and shall provide the materials and labor necessary in operating their devices.

Eleventh.—The following are constituted Sections of the Board of Examiners:

I.—Dynamo-Electric machines for lighting.

II.—Dynamo-Electric machines for plating.

III.—Dynamo-Electric machines for miscellaneous purposes.

IV.—Dynamo-Electric motors, and Transmission of energy.

V.—Arc lamps.

VI.—Carbons for arc lamps.

VII.—Incandescent lamps.

VIII.—Photometric measurements.

IX.—Dynamometrical measurements.

X.—Boilers.

XI.—Steam engines.

XII.—Gas engines and other prime motors.

XIII.—Apparatus for high electro-motive force:—1, Lightning protection; 2, Electro-static induction machines and induction coils; 3, igniters.

XIV.—Voltaic-electric apparatus:—1, Voltaic batteries and acessories; 2, Polarization and storage batteries.

XV.—Electro metallurgy.

XVI.—Thermo and magneto-electric apparatus.

XVII.—Electric conductors:—1, Telegraph and telephonic wires and cables; 2, Electric light and power circuits; 3, submarine cables.

XVIII.—Underground conduits

XIX.—Electric telegraphs:—1, Morse system; 2, Printing telegraphs; 3, Duplex, quadruplex, multiplex and harmonic systems.

XX.—Telephones, microphones and radiophones.

XXI.—Fire and burglar alarms and annunciators.

XXII.—Electro-signal and registering apparatus.

XXIII.—Electro-therapeutic apparatus.

XXIV.—Electro-dental apparatus.

XXV.—Applications of electricity to musical apparatus.

XXVI.—Applications of electricity to artistic effects and art productions.

XXVII.—Applications of electricity to warfare.

XXVIII.—Instruments of precision.

XXIX.—Educational apparatus.

Respectfully submitted by the Committee:

M. B. SNYDER, Chairman.
EDWIN J. HOUSTON,
WM. D. MARKS,
WM. P. TATHAM.
CHAS. H. BANES.

The following rule (12) of the general rules and regulations of the Exhibition is republished for the information of examiners:

Twelfth.—No awards or premiums are offered by the Institute, but in place thereof a report to the Institute will be prepared by a Board of Examiners, which report will be as full as the time and opportunity will permit. Exhibitors are requested to give, at the time of the opening of the exhibition, detailed descriptions of their exhibits, addressed to the Board of Examiners, describing the merits of each exhibit as understood by the exhibitor, such matter, at the discretion of the examiners, to be used in their report. If, however, any of the exhibitors desire expert examination or competitive tests of their displays, such tests will be conducted by the Institute to the extent practicable in the time, provided the cost of the materials and instruments used be borne by the exhibitors desiring the test. The Special committees to whom these tests will be referred will be appointed by the Board of Managers of the Institute, subject to the approval of a majority of those asking for the test if it is competitive. The original copy of all reports shall remain the property of the Institute, which shall have the first right of publication.

The Institute reserves the right to enter into such other scientific work touching the Exhibition (not requested by the exhibitors) as in its judgment may tend to the advancement of science.

The Examiners shall be appointed by the Board of Managers, and shall be men of acknowledged integrity, skill and experience in the class of goods assigned to them; and no Examiner shall serve on any class in which he may be an exhibitor or be otherwise directly interested. The mornings of each day until fifteen minutes before the time of opening the Exhibition, shall be appropriated by the Examiners, who shall be attended only by such persons as they may invite to be present.

Globe Lightning.

On the evening of February 24th, a rain and hailstorm passing over Amiens, suddenly startling the inhabitants by one most vivid and unexpected electric flash, immediately followed by violent thunder. This flash appears to have resolved itself into a number of glowing, but harmless, globules. For this division of the lightning M. Decharme has only one witness, who states that he saw the brilliant mass burst asunder and descend in various directions. The globules, however, were observed at seven different places, the most extreme being almost a mile apart, and were always seen under very similar circumstances The lightning struck the theater, and pierced one window with an oblong hole about an inch long, the edges of which were very brittle, but not fused; it passed then as a small glowing ball of a bluish tint behind the scenes, narrowly missing several actors. It finally disappeared with a slight explosion, doing no further damage, and leaving no traces whatever. A similar flame was observed in two houses, which it entered probably through the open windows. At another place, a woman standing at the open door, saw a bluish flame, as big as an egg, fall from the rain pipe; it exploded like a gun. The terrified woman rushed into the kitchen, and had time enough to sit down before she heard the violent clap of thunder which startled the whole town. In a fifth house, it came down the chimney, lifted up one of the stove hobs, and traversed half of the kitchen in the form of a fiery globe of the size of an orange; there was again an explosion, but no damage, and no smell of ozone, just as in the other cases; the thunder followed afterwards. The blue flame was further noticed in a restaurant, and finally in another house, where it stretched a telephone wire, deranged the electric bell, then with a report passed into the house itself, and along the supper-table, where it hurt the hand of the master of the house, rendering it useless for some minutes, and finally disappeared mysteriously. The lightning thus behaved like a water jet falling upon some solid body, and spirting out in little globules in all directions; these globules were hurled away and showed no preference for good conductors in their descent. The whole occurrence is very peculiar, but seems to point to a certain relation between electric and liquid currents, for which Professor Decharme has brought many an unexpected experimental proof. We hope on an early occasion to acquaint our readers with the results of further recent investigations of M. Decharme. —*Engineering.*

Pure Air and Electric Lights.

The good or evil influences of the artificial light we use upon the health is of the very highest importance, although hitherto it has been to a great extent overlooked. Ancient custom has so familiarized us with combustion as a source of light that, until recent years, we hardly ever dreamed there could be any other. Nevertheless, the introduction of the electric light has been opening our minds of late to the advantages of a purer kind of illumination. Pure air is what we all seek when we go to the seaside or the mountain top during our holidays.

How important, then, is it that we should have pure air in our homes. The necessity which obliges us to live in towns also obliges us to live in a more or less vitiated atmosphere. The mere fact of so many living beings crowded together is of itself sufficient to deteriorate the air. Assuredly it is not desirable that the very light we use should also vitiate the atmosphere. Pure air and light are essential to good health, but in close, ill-ventilated city offices, and in thousands of homes and workshops, what prospect is there of a pure air while the lights which are burned often half the day are of themselves polluting it? For not only does a candle, oil, or gas flame waste the oxygen of the air, and thus rob it of its life-supporting virtue, but it actually soils it with noxious vapors, the product of combustion. These are chiefly water or steam and carbonic acid; but carbon dust, or soot, is also thrown off, and in the case of gas, of sulphurous acid. Gas and other lights produced by combustion not only rob the air of its health-giving oxygen; they adulterate what remains of it.

Carbonic acid gas, which is supplied to the atmosphere from a flame, is an active poison fatal to animal life. It is the "choke damp" of the miner, and though always present in minute quantities in the atmosphere, it becomes dangerous when in excess. On the score of health alone the introduction of electric light ought to be hastened as much as possible, nor should it be only the luxury of the rich, as a famous electrician, recently deceased, proclaimed it, but the necessity of the poor. Where purity and brightness are most needed, there purity and brightness should first come.

Commissioners to the Electrical Conference.

The President has appointed R. A. Fisk, of Connecticut; John Trowbridge, of Massachusetts; Henry A. Rowland, of Maryland, and Geo. F. Barker, of Pennsylvania, Commissioners to the National Conference of Electricians, to be held at Philadelphia in the autumn of this year.

—— The system of electric lighting presented by the Southern Exposition is the most extensive ever shown in one illuminated structure. The area of the main building is 677,400 square feet, with an average interior height of forty feet. To illuminate this vast space the Edison Company will furnish 4,700 incandescent lamps, equal to 90,000 candles. The wire used is over forty miles in length. The electricity is generated by fifteen dynamo machines and eight engines, this being a plant sufficient for a city of forty thousand inhabitants. This is three times as much light as shown by all other combined systems of incandescent lighting in any electrical exhibition ever held. At the Vienna Electrical Exposition last year there were but 1,500 lights of all other systems against 4,700 at the Southern Exposition. The Art Gallery will also be illuminated by the Edison light. Since the Southern Exposition of 1883 Mr. Edison has been perfecting his system for extensive interior lighting, and this year the Southern Exposition will present on the most extensive scale ever attempted, not only the Edison system, but all the inventions and improvements made by Mr. Edison in his studies and experiments during the year. The exterior lighting in the park and in the amphitheater and some of the annexes and courts will be by the Jenney Arc Light system. One of the features of this lighting will be the lighting of an iron tower ninety feet high in front of the amphitheater, and brilliant concentration of lights over the streets at the main entrances. The Southern Exposition of 1884, except for the great importance of its other features, might be considered an electrical exhibition. The illuminating system for practical use and convenience, the representative displays of light by other systems placed on exhibition, the requirements of other displays requiring electric power will make the Southern Exposition bring within the area of its boundaries more electricity than has ever been generated and expended on any equal space anywhere in the world.

ELECTRIC LIGHT NEWS

—— It is stated that the Ambigue Theatre in Paris is to be lighted by arc and incandescent lamps. Twenty of the former and three hundred of the latter are to be tried at first.

—— An industrial exhibition has been opened at Rouen. The interior is lighted by Breguet arc lamps, Swan lamps, and Jablochkoff lamps. Among the exhibits is a small electric railway.

—— Now that Chestnut Street, in Philadelphia, is brilliantly lighted with arc lights, the other streets look dark and dangerous, and the people are demanding more light, and are determined to have it.

—— The Philadelphia gas men agree with those of other cities in this country and abroad in saying that the use of the electric light, so far from hurting the gas interest, rather tends to increase gas consumption. The brilliancy of the electric light causes people who use gas to burn more of it to compete in illumination.

—— The steamship Yarra, belonging to the Messageries Maritimes, is lighted by means of 188 Swan lamps, 166 being 10 candle-power, and twenty 20 candle-power lamps. Two compound wound Siemens dynamos supply the necessary current. There is also telephonic communication between the bridge and the captain's cabin at the stern. Ader telephones are used, and the captain reports that they have worked extremely well.

—— Maj. L. B. Wright, for three years general superintendent of the Brush Electric Light Company, and for the past year engineer of the Jarvis Engineering Company, of this city, has to-day (26th inst.) tendered his resignation to the latter company to accept the position of general superintendent of the American Electric and Illuminating Company, vice C. D. Smith, who assumes the position of general manager next Monday. Since the American Company was organized, Mr. Goff has occupied the position of president and general manager; but the rapid growth of the business has necessitated a division of responsibilities, as he finds himself unequal to the management of the entire details of the business. Mr. Smith's experience in the business fits him for the new office he is to fill, and Maj. Wright's long and successful experience as a mechanical engineer, and his thorough knowledge of the electric lighting business generally, make him a valuable acquisition to the American Company. Maj. Wright is a brother of the Hon. Carroll D. Wright, so well and favorably known in Boston.

—— The steamer Thistle, belonging to the Glasgow and Londonderry Steam Packet Company, has been fitted with the electric light by the Pilson-Joel Electric Light Company, of London, under the superintendence of Professor Jamieson. The installation includes 41 lamps, each of 20-candle power, distributed over almost the whole of the ship, including the steerage and cattle holds. In all cases the lamps are inclosed in ground glass shades or wire frames, and in the portion of the ship set apart for the first-class passengers, the lamps are fitted both in the saloon and the adjoining state-rooms. There are in all 17 lamps in the saloon circuit; there are ten lamps in the steerage circuit, which includes the engineer's room and chart room on the upper deck adjoining the engine casing. For the cattle holds there are two circuits, so that if goods rather than cattle are being carried, one or both of them can be cut out at pleasure. In each of these circuits there are four lamps. The rest of the lamps —six in number—form the engine-room circuit. The dynamo used is of the Schuckert type, manufactured by the Pilsen-Joel Company. It develops an electromotive force of 102 volts, and supplies each lamp with .66 amperes, or a total of 27.2 amperes for the 41 lamps. The speed required, which has been made low in order to suit ship lighting, is 450 revolutions per minute.

ELECTRICAL PATENTS

INDEX OF INVENTIONS FOR WHICH LETTERS PATENT OF THE UNITED STATES WERE GRANTED IN THE WEEK ENDING JULY 22, 1884.

302,245 Feed-water alarm; George W. Getchell, Brewer, Me.

302,319 Dynamo-electric machine; Chas. F. Brush Cleveland, O.

302,330 Telephone switch; Henry K. Goodwin, Lawrence, Mass., assignor of one-half to Albert D. Swan, same place.

302,344 Telephone exchange system; Walter H. Knight, New York, N. Y.

302,360 Telegraphic transmitter; Christian G. Spengler, Hoboken, N. J., assignor to William A. Leggo, Montreal, Canada.

302,364 Telephone exchange system; Henry E. Waite and Samuel H. Bartlett, New York, N. Y., assignors to Charles F. Livermore, trustee, same place.

302,377 Electric cable; Edw'd M. Bentley, Brooklyn, N. Y.

302,378 Underground electric way; Edward M. Bentley, Brooklyn, N. Y.

302,410 Quadruplex telegraph; Francis W. Jones, New York, N. Y.

302,417 Mode of winding field magnets of dynamo-electric machines; Richard H. Mather, Windsor, Conn.

302,418 Dynamo-electric machine; Richard H. Mather, Windsor, Conn.

302,447 Electric gas-lighter; Thomas Taylor and John Taylor, Oldham, county of Lancaster, England.

302,460 Dynamo-electric machine; Jas. J. Wood, Brooklyn, assignor to the Fuller Electrical Company, New York, N. Y.

302,475 System of communication with moving trains; George E. Fullerton, Paris, Iowa.

302,485 Electrical safety appliance; Killingworth William Hedges, Westminster, county of Middlesex, England.

302,502 Synchronous telegraphy; Paul La Cour, Copenhagen, Denmark, assignor to Fred. P. Jones, Portsmouth, N. H.

302,505 Electric train signal; Lafayette W. Lindley, Danville, Ky.

A printed copy of the specification and drawing of any patent to the annexed list, also of any patent issued since 1865, will be furnished by any of the patent solicitors whose advertisements appear in this journal. In ordering please state the number and date of the patent desired.

If an invention has not been patented in the United States for more than one year, it may still be patented in Canada. Cost for Canadian patent, $40.00. Various other Foreign patents may also be obtained.

The transfer of the ownership of the Hartford Electric Light plant, constructed by the American Electric and Illuminating Company, to a syndicate of leading Hartford citizens, is an important event. It is highly advantageous to the American Company, because it is a large and profitable sale: but, further than this, it is significant, because some of the strongest and best business men in New England have taken to electric lighting interests. The whole force of the local gas interest was pitted against the electric light, but had to surrender when it came to a test of quality and economy.

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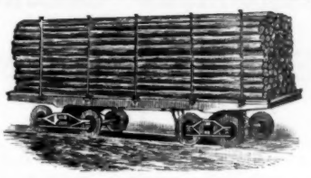

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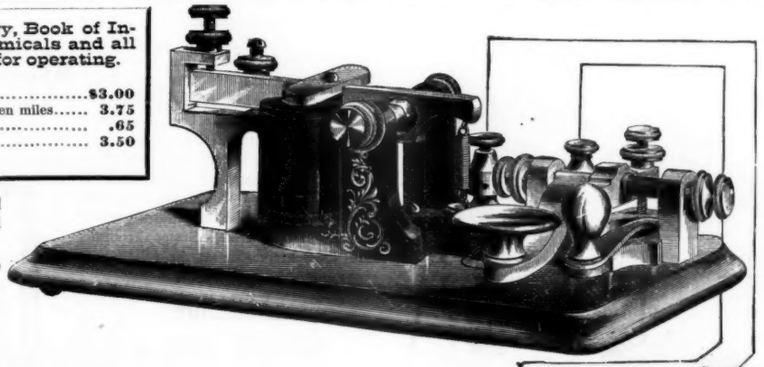

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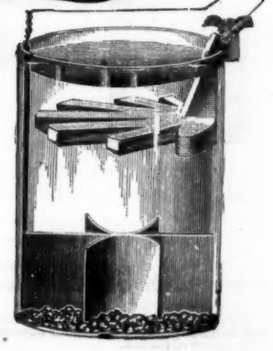

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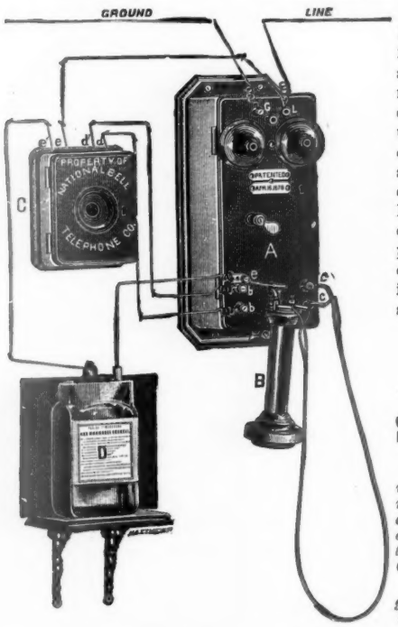

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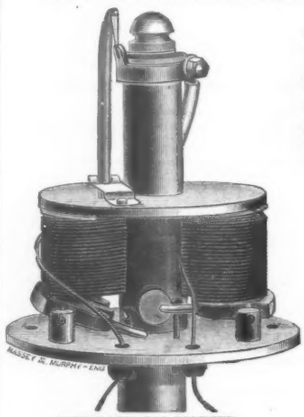
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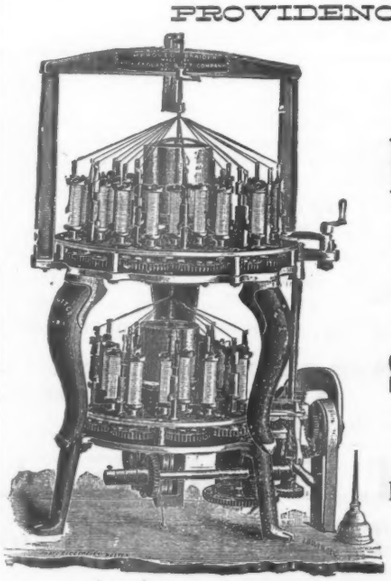

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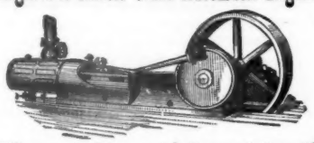

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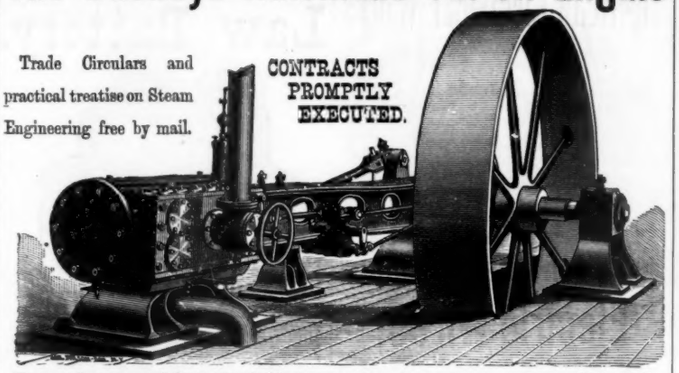

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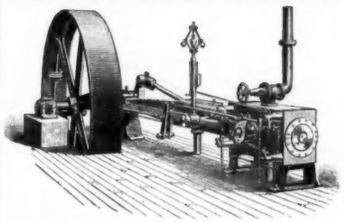

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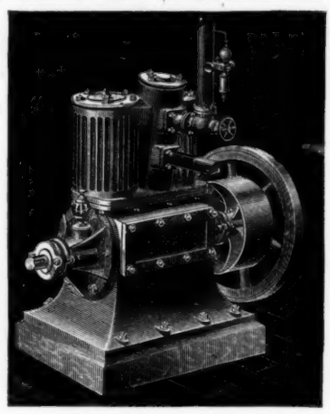

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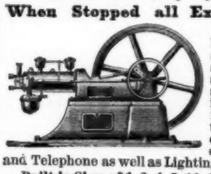

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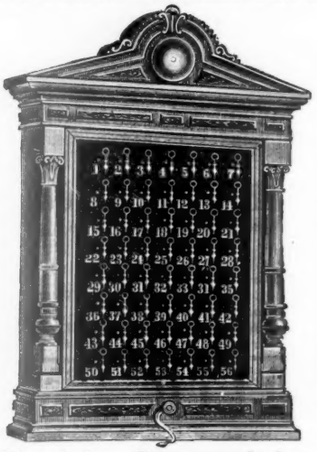

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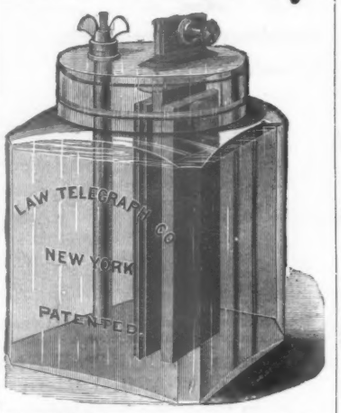

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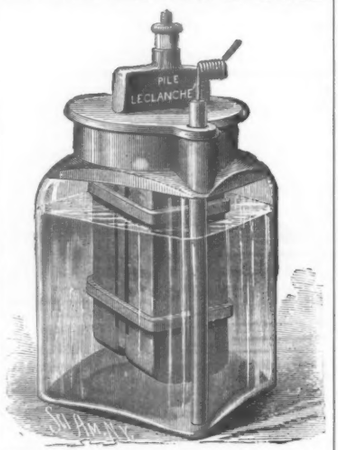

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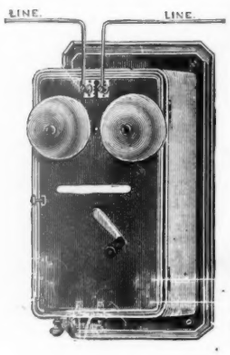

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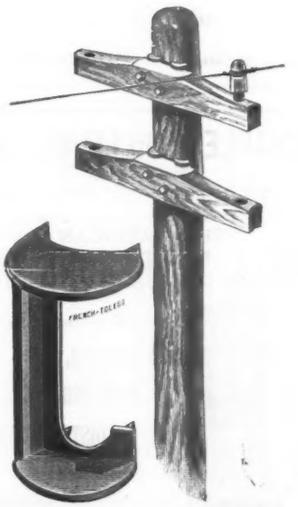

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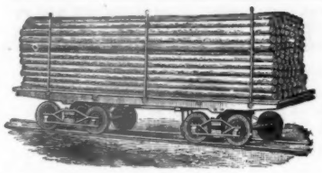

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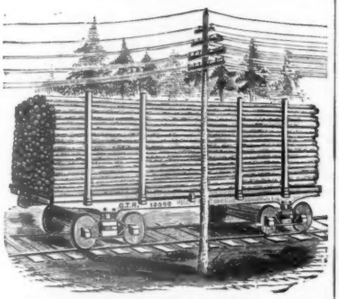

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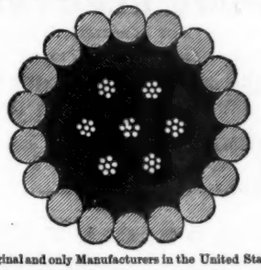

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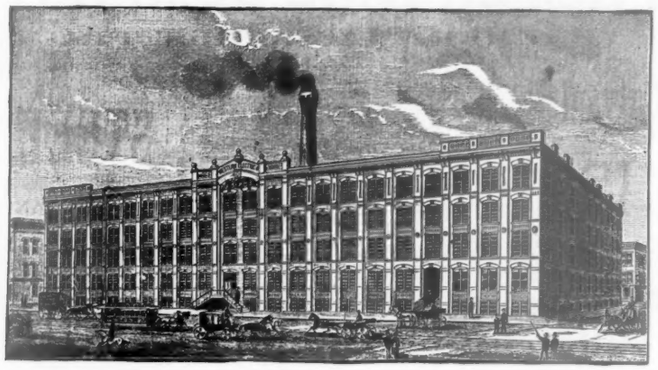

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